



# **NAVAL POSTGRADUATE SCHOOL**

**MONTEREY, CALIFORNIA**

## **THESIS**

**AN ANALYSIS OF HISPANIC MIDSHIPMEN SUCCESS  
AT THE UNITED STATES NAVAL ACADEMY**

by

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June 2005

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**AN ANALYSIS OF HISPANIC MIDSHIPMEN SUCCESS AT THE  
UNITED STATES NAVAL ACADEMY**

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## **ABSTRACT**

This research studies the success of Hispanic midshipmen at the Naval Academy. Specifically, graduation, senior leadership positions during first class (senior) year, military performance grades, and cumulative academic Quality Point Rating (college GPA) are examined as the measures of success. A host of pre entry variables are used to control any affect they might have that would otherwise be confounded with midshipmen's ethnic, racial, or gender identification. Midshipmen from the classes of 1999 to 2004 compose the dataset for regression analysis. Hispanic midshipmen cannot be studied in a vacuum, and therefore, this research generates information on a number of different groups. But, the performance of Hispanic midshipmen at the Naval Academy is of primary focus throughout. Of the four measures of success, this study shows that Hispanic midshipmen are likely to have a lower cumulative academic QPR; but, are proportionately represented in terms of graduation, senior leadership positions, and military performance grades.

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# **I. INTRODUCTION**

## **A. BACKGROUND**

The mission of the United States Naval Academy (USNA) states that midshipmen are expected to graduate and serve their nation in many ways, in and out of the military. Although the mission has not changed, the composition of the Brigade of Midshipmen and the Navy it serves in upon graduation has changed. An analysis of who is admitted, how they succeed, and who graduates, will assist the Naval Academy to continue to fulfill its obligations for the Navy and the nation.

Minorities and females have been the focus of many studies at the Naval Academy. The GAO, several internal studies, and several theses have all contributed; but, none have concentrated on Hispanics. Hispanics are the largest minority group at the Naval Academy and have been since 2000 (USNA Institutional Research Department [IR], 2004). Today, the United States military is more racially and ethnically diverse than at any other time in its history. This is especially true of the Navy and Marine Corps. In the officer communities, the Navy and Marine Corps have more Hispanic officers as a percentage of the community than the Army, Coast Guard, or Air Force (DEOMI, 2004).

Along with the rising numbers of Hispanics in the Navy and Marine Corps, the percentage of Hispanics is growing nationwide. The 2000 census showed the percentage of Hispanics in our nation's populations eclipsing that for African Americans for the first time. Then, Hispanics numbered 35.3 million and African Americans numbered 34.7 million, 12.5% and 12.3 % respectively. The growth is predicted to be such that by 2050 Hispanics will compose 24% of the population (US Census Bureau [Census], 2004).

Every year since 2000, more Hispanics have graduated from the Naval Academy than African Americans; but, 1991 marked the first time Hispanics outnumbered African Americans graduating from the Naval Academy (IR, 2004). Because there are more

minority officers today, and Hispanics are the fastest growing minority group in the nation (Census, 2004), it is easy to see the worth of studying the Hispanic population at the Academy.

The Navy, Marine Corps, and Naval Academy will be well served by devoting appropriate resources in studying the future impact of our nation's growing Hispanic population and its impact on the officer and enlisted communities. In the next ten to fifteen years the Navy and DOD will find Hispanics as the largest minority group in the officer communities. The value of this study is that by focusing on factors that predict or enhance success of Hispanics at the Naval Academy, it provides the administration officials the means to anticipate the demographic changes; while insuring the highest graduation rates and strong performance of Hispanics who apply to the Naval Academy.

## **B. OBJECTIVES**

The primary goal of this research is to give USNA administration officials information and insights about Hispanic midshipmen performance relative to other racial or ethnic groups. These insights, whether they confirm previous assumptions about midshipmen performance, or contradict them, will add to the body of knowledge currently available. Simple graduation statistics and other performance indicators can be misleading because there are many factors affecting a midshipman's performance and chances for graduation that descriptive statistics cannot explain. Therefore, statistical regression analysis of midshipmen is needed. This study intends to serve as a model for future research for other ethnic and other demographic groups.

## **C. RESEARCH QUESTIONS AND METHODOLOGY**

A literature review will identify potential dependent and independent variables that have meaningful predictive power. All but one of the independent variables (ethnic or racial identification) will serve as control variables. This is necessary so factors contributing to college success can be appropriately incorporated into statistical regression models. Preliminary analysis of chosen variables using descriptive statistics is required to construct a table of hypothesized outcomes of the models prior to regression

analysis. These models will attempt to predict the more important measures of success for midshipmen at the Naval Academy. In so doing the first question this study seeks to answer is:

- Are there appreciable differences in Hispanic midshipmen success relative to other ethnic, racial, or gender groups at the Naval Academy?

Other, subordinate questions are:

- If there are appreciable differences, where do these differences manifest themselves?
- How can this study aid future research into midshipman performance?

#### **D. SCOPE AND LIMITATIONS**

This study will concentrate on midshipmen that were members of the classes of 1999 to 2004. There are many ethnic groups at the academy, but combining groups will be done to minimize complexity. Five ethnic categories will be used which necessitates grouping some together. While not ideal, doing so should reduce inaccurate results from regression analysis due to the small numbers of certain ethnic groups at the academy. It should be noted that much of the demographic information to be used in this study is self reported; so the ethnicity or race of a particular midshipman is whatever he or she reports regardless of established or accepted definitions.

The term Hispanic is a collection of ethnic and other groups but is often compared with other groups defined by race, ethnicity, or nationality. The definitions of these other groups (White, Caucasian, African American, and Asian American to name a few) all vary as well. For the purposes of this study all groups will fall under the collective label Demographic Group and one can be a member of only one group. They could be either African American or Hispanic in this study, but not both. This classification scheme, while simple and efficient, may run the risk of oversimplifying someone's heritage.

Predicting graduation rates and other measures of success for a group of midshipmen is very complex. Many of the variables that can impact a midshipman or group of midshipmen's graduation probability can be placed into several categories. This study will focus on pre entry attributes. Measured test scores, other quantitative

measures of performance or preference, and certain qualitative bio-data are some examples. Because of the need to limit the numbers of variables included in this study factors such as socioeconomic status, parental income, home of record, and other socially oriented data were not used. Primarily, the focus of this study is on variables that previous studies have found to have predictive success in higher education.

Variables that measure or quantify institutional experiences were purposely excluded from in this study for two reasons. Firstly, the scope of this study is rather large in analyzing the pre entry attributes available for the research. Essentially, information captured and used the Naval Academy Admissions Board (components of the cumulative multiple, gender, racial or ethnic affiliation, and personality) were used as independent variables. Secondly, post-entry or institutional experiences are represented in the dependent variables or measures of success. The measures of success to be studied are graduation, academic GPA (labeled quality point rating or QPR at the Naval Academy), leadership positions in the Brigade (labeled striper), and military performance scores (subjective rating of one's overall military record). These measures are similar to established measures of success in college settings. Examples that are seen in studies at civilian universities include cumulative college GPA, graduation, enrollment into graduate school or advanced education, leadership (elected or appointed to office), and accomplishments (scientific, artistic, and physical) (College Entrance Exam Board [College Board], 2001).

Throughout this study there is a fair amount of selection bias (by applicants and the Naval Academy) that takes place, and this study will not address this limitation in any direct ways. However, some efforts are in place and used by the Naval Academy Admissions Board to address range restriction in determining which applicants receive an appointment to attend.

## **E ORGANIZATION OF STUDY**

This thesis is structured into six chapters. Chapter I frames the goals of the thesis. Chapter II summarizes previous research on the success of Hispanics in post secondary education in the United States, and past studies on midshipman performance at the Naval Academy. Chapter III focuses on development of theoretical and statistical models to be

used; identifies the variables for each model; defines the variables; and states testable hypotheses of the predicted effect these variables have on midshipman success. Chapter IV concentrates on preliminary descriptive data analysis. Chapter V summarizes and interprets regression model results. Lastly, Chapter VI closes the study with conclusions and recommendations for future research.

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## **II. LITERATURE REVIEW**

The purpose of this chapter is to provide the reader information that will serve as a foundation for this study. Specifically, a discussion on the term Hispanic, a historical review of Hispanics in the military, a discussion of Hispanics and other groups in higher education, and a review of previous studies done on minorities, athletes, and personality types at the Naval Academy is covered. The last section introduces the types of information and variables to be used for quantitative analysis in this study.

### **A. THE TERM HISPANIC**

Before a meaningful review of Hispanics begins, a proper definition of the term Hispanic is necessary. Hernandez (2002, p. 5) aptly phrased what it means to be Hispanic in his work on Hispanic officer recruiting for the Navy. He wrote:

If someone were to identify herself or himself as a "Hispanic," what exactly would that mean? Does it mean the person is a Spanish speaker? Does it imply a particular race? Does it have something to do with religion? Does it mean one has a Spanish surname? The answer to the first question is, "it depends," and the answer to the subsequent questions is, "not necessarily." This is exactly why examining the "Hispanic" population of the United States poses some very unique challenges.

For the purposes of this study the definition for Hispanic will be that which is used by Office of Management and Budget (OMB). The U. S. Census Bureau, for its 2000 census, chose this federal agency's definitions. According to the OMB, Hispanic or Latino is defined as follows:

A person of Cuban, Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race. The term, "Spanish origin," can be used in addition to "Hispanic or Latino."

Some have criticized this and similar definitions because it is too broad and ignores the many differences members of the Hispanic category may have (Bean and Tienda, 1987). However, it appears that the term Hispanic has been established in American society and will continue to be used. Regardless how Hispanic is defined, the term Hispanic and other ethnic or racial groups represented in this study are ultimately self-reported characterizations.

## **B. HISPANICS IN THE MILITARY**

Hispanics have served in every conflict in or out of uniform, as citizens or non-citizens of the United States since the revolutionary war. Then, the term used was Spaniard and meant someone of Spanish descent that was born in the Americas or in Spain. Governor (of Louisiana) and General Bernardo de Galvez led Native Americans, freed African Americans, and his own Spanish regular soldiers to action against the British in Louisiana and Mississippi. One of his officers born in Venezuela, Francisco de Miranda, participated in the siege and surrender of Pensacola and also the capture of the Bahamas (Riochen & Fernandez, 2002).

During the U.S.-Mexican war from 1846 to 1848 and the Civil War, Hispanics continued to serve in the U.S Armed forces. Many know of the Hispanic Admiral David G. Farragut, the first admiral of the U.S. Navy who was promoted to that rank in 1866 for his victory in the Battle of Mobile Bay. Less known is his father, Captain Jorge Farragut. He served in the Navy during the War of 1812; but, little research into his contributions and those of other Hispanics during this time period has been conducted. The Civil War also marks the first time Hispanics were awarded the Congressional Medal of Honor. Philip Bazaar and John Ortega both served in the Navy and both were born outside the U.S. (Riochen, 2002).

The Civil War also marks the first time African Americans were officially allowed to serve in the defense of their nation since the American Revolution (they served despite official exclusion during the War of 1812). Hispanics and African Americans served side by side under the leadership of Luis Fellenosa Emilio, a company commander in the 54th 'Colored' Regiment. He was one of the few officers that survived the charge on Fort Wagner, South Carolina, and later became the regiment's commander. His memoirs served as the basis for the 1989 movie, "Glory" (Riochen, 2002).

Hispanic participation in the defense of the United States continued through the end of the 19th century and in the Spanish-American War. Of note was Maximiliano Luna, an Army Captain serving with Theodore Roosevelt in the Rough Riders. Maximiliano descended directly from the conquistadors that settled the New Mexico

region in 1650. He joined the Rough Riders at the age of 38, having been educated at Georgetown University and after serving as a sheriff in New Mexico (Riochen, 2002).

Hispanic involvement continued at the turn of the Century and is marked by the third Hispanic to be awarded the Medal of Honor while serving in the Marine Corps – France Silva. He, along with other Marines and Sailors, fought the Boxers in China, helping to maintain peace during the summer months of 1900 until allied armies came to relieve them in August 1900. Unfortunately, by WWI Hispanics were relegated to menial jobs. Approximately 250,000 to 500,000 Hispanics served in WWI. A more accurate statistic is not known because of inaccurate records. However, there are accurate records showing 53,000 Puerto Ricans were drafted to serve in WWI (Riochen, 2002). These data are more accurate than other information regarding Hispanic participation in WWI because almost all residents of Puerto Rico are Hispanic.

During WWII Hispanics continued to serve with distinction. Donald S. Lopez served his country in the Flying Tigers (technically a non-government employee at the time), became an ace (downed five or more enemy aircraft in action), and continued his career in the Army Air Corps and then the Air Force. Hispanics served in every major campaign and 12 received the Medal[s] of Honor (Riochen, 2002).

Today, there are more Hispanic officers and enlisted men and women as a percent of the force serving in the Navy and Marine Corps than the other uniformed services (DEOMI, 2004). While continuing to excel in the today's battles, Hispanics and other racial or ethnic groups find success and achievement in other areas of the military. At the Naval Academy Hispanics are given the chance to walk in the footsteps of their predecessors; but, they and other groups appear to have more difficulty in excelling than the majority group (male Caucasians). An in depth review of ethnic, racial, gender, and other group performance in higher education is necessary if one is to understand these differences.

## **C. ETHNIC GROUPS, GENDER, AND SUCCESS IN HIGHER EDUCATION**

The question I like to ask every child I visit in the classroom is, ‘Are you going to college?’ In this great county, we expect every child, regardless of how he or she is raised, to go to college.

President Bush at Griegos Elementary School, Albuquerque,  
New Mexico on August 15th, 2001

President Bush’s statement above points to the future. He and many others believe that a large part of the success of our nation in the coming decades depends on an educated population. Understanding how Hispanics perform in institutions of higher learning is needed in order to turn the President’s vision into reality.

### **1. Hispanic Enrollments**

If one had to describe the state of Hispanics in higher education today in one word, it might be bittersweet. There have been enormous gains over the past 15 years. Yet, there are some indicators that point in the other direction. Because the Hispanic label encompasses approximately two dozen nationalities and types of people with very different demographic characteristics it can be difficult to come to a clear understanding. Are Hispanics more likely to enroll? Are they more likely to graduate as compared to Whites, Asian Americans or African Americans? These and others questions do not have statistics that point to a simple or conclusive yes or no answer. The answer tends to be, “it depends.”

For instance, Hispanics are more likely to enroll in higher education despite the fact that fewer graduate high school relative to African Americans. Ten percent of all Hispanic high school graduates enroll in some form of college versus 7% of the total U.S. population; only Asian Americans are higher. But, the schools they tend to gravitate toward are two-year, open admission community colleges that many studies have shown hinder attainment of a Baccalaureate degree. Hispanics are more likely to be part time students than are White or African American Institutions. They tend to be older than the average college student, (College Board, 2001; Thernstrom and Thernstrom, 2003; Fry, 2002). These factors contribute to Hispanic graduation rates lagging that for Whites by about 20 percentage points (Swail, Cabrera, and Lee, 2004).

This gap mirrors that of Italian immigrants during the early part of the 20th century and is predicted to close for the same reasons attributed to Italian American educational progress. At the time, Italian immigrants adhered strongly to the “old-country culture”; but, as time went on, Italians integrated more and more into American culture, and with this integration came better academic performance from grade school to college and beyond (Thernstrom, 2003, p 102). The same can be true for Hispanics in the future; although the pull of the old-country culture for the largest sub-group of Hispanics (Mexican Americans) in the southern and western U.S may prove difficult to overcome. But, the distribution of Hispanics across the U.S. is also changing. Reports from the U.S. Census Bureau show that Hispanics are fanning out over the nation and have populations in Georgia and North Carolina, Iowa, Arkansas, Minnesota, and Nebraska; these states are not known for sizeable Hispanic populations in decades past (Guzman, 2001).

There is more encouraging data on Hispanics in higher education however. Hispanics trail Asian Americans but are ahead of Whites and African Americans in how likely they are to enroll in Tier 1 or highly selective schools<sup>1</sup>, and also how many are enrolled in these selective school as a percentage of the group (NCES, 1998). Another study confirms this finding. Fry (2004) published a report for The Pew Hispanic Center that compiled data originating from the National Center for Education Statistics in 2004. Hispanics in the highest quintile<sup>2</sup> of high school students are entering the most selective colleges and universities on a comparable scale with other groups. The Center’s report shows the current enrollment rate of Hispanic undergraduates in the highest quintile to highly selective institutions (colleges and universities) is slightly higher than that for White undergraduates (8.8% vs. 8.5%), over double that of African-Americans (3.0%), and 1.2 percentage points behind the combined average in this category. Asians bring up the overall average. Additionally, Fry ran several simulations attempting to predict Hispanic graduation rates. He found that if Hispanics went to same types of colleges Caucasians went to in same numbers, their graduation rates for selective and highly

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<sup>1</sup> These are the top 50 ranked colleges or universities in the following categories: national universities, national liberal arts colleges, regional universities, regional liberal arts colleges, and an Other category.

<sup>2</sup> The rating scale for finding the highest quintile is based on a measure of “high school academic intensity” defined by a combination of: mathematics credits, highest level of math, total advanced placement courses, English credits, foreign language credits, science credits, core laboratory science credits, social science credits, and computer science credits.

selective institution jumped 50%. Unfortunately, the term “highly selective institution” was never defined in Fry’s report, but one can assume that they are places with a rigorous application process and higher entrance requirements. The Naval Academy should certainly be in this category.

## **2. Test Score Contrasts by Gender and Ethnic Groups**

College entrance tests and other quantitative information has been the bedrock of admission into higher education for many years, and numerous studies have been done on the SAT and other objective performance indicators assessing their fairness. In 2001 the College Board (responsible for the SAT) published a report summarizing previous studies examining the SAT and other factors colleges consider for student admission. Not surprisingly, it found that the combination of SAT scores and high school performance (rank or GPA) are the best predictors for academic performance, nonacademic accomplishments, leadership in college, and post college income. The report also recognized the need for colleges to find other factors that contribute to student success in college. Unfortunately, many of studies in the report did not focus on Asian Americans, Hispanics, and Native Americans.

With regard to females, the report combined data from all the studies and found women were more likely to graduate from four year institutions with a Baccalaureate degree than men (after controlling for SATs and high school performance). The accuracy of the studies in predicting female attainment of Baccalaureate degrees was also better for women than men. Females were also more likely to enroll in Tier 1 national universities (College Board, 2001).

African Americans, on the other hand, were found to have lower attainment rates to Baccalaureate degrees when compared to Whites or Asian Americans after controlling for SAT scores and high school performance. One characteristic that females and African Americans had in common was the phenomenon of under prediction. That is, females and African Americans tend to have lower SAT scores relative to male college students for the same level of college performance (College Board, 2001).

Another key finding in this study was that SAT scores and high school performance did a better job of predicting first year and cumulative GPA and continued

enrollment past the first year than attainment of the Baccalaureate degree. Two explanations are offered; the first is SAT scores and high school performance are not as close in time or content to the outcome variable of degree attainment. The other reason is there are many other factors that affect one's ability to earn a degree. Some of these "non academic" factors are finances, motivation, social adjustment, and family problems (College Board, 2001). Some of these factors are also called "at risk" factors. Some of these factors apply to midshipmen at the academy; but, most do not given the unique environment of the Naval Academy. For instance, midshipmen cannot be married, have no dependents, are paid students; and all are indoctrinated into military life. These are some of the many aspects of the midshipmen experience that nullify most of the risk factors found in civilian institutions. Instead, a different type of risk factor may exist at the Naval academy that is not addressed in the literature; and that is the degree to which a particular midshipman fits (or does not fit) into the military life style or culture. A midshipman that does not integrate well into the traditions of the Navy and Naval Academy may have a more difficult time in finding success (Tinto, 1993).

The College Board (2001) report had other important findings as well. One was that admissions office ratings used in selecting high school graduates for matriculation contributed significantly to predicting various measures of success and complemented more objective ratings (College Board, 2001). At the Naval Academy, the Admissions Board uses a subjective rating called Recommendations of the Admissions Board (RABs) (USNA, 2002). The College Board report also showed that the more technically oriented a school, the better one's SAT scores and high school performance were able to predict various measures of success in college. This implies that SAT and high school performance should be better predictors of success at the Naval Academy than at non technical schools given the majority of midshipmen are enrolled in engineering or science majors and all take a common technical core curriculum (IR, 2004).

Unfortunately many of the studies reviewed by the College Board did not address or correct for known deficiencies in statistical analysis. Range restriction and using linear probability models to predict binary outcomes are some of the limitations the studies in the past have had and should be avoided or addressed in future studies.

### **3. Factors Impacting Collegiate Success**

#### ***a. Risk Factors***

The reasons leading to collegiate success or failure are many and complicated. Many studies have broken down the reasons (often called risk factors) into two main categories. The first tend to fall into academic performance, and the second category is defined by social interactions (Tinto, 1993). For the academic category, many risk factors reflect the level of preparation a student has prior to matriculating. The focus of this portion of the literature review is on both types of risk factors with a particular emphasis on the social interactions that more objective data may not well explain.

The Naval Academy shares much with civilian institutions of higher learning; but, there is much that makes the four years the midshipmen spend at the Naval Academy very unique. Many risk factors (commuting to school, finances, working and continuous enrollment) do not apply. Others however, do apply. For instance, students with a C or lower in high school GPA (Swail et al., 2004) have a lower likelihood of achieving success in college. This describes a small group of midshipmen at the Naval Academy; one that is disproportionately populated by Hispanics and African Americans. These midshipmen graduate at a lower rate compared to the average graduation rate (IR, 2004).

What are the implications of the data showing the lower graduation rate at which Hispanics populate the lowest quartile of midshipmen in SAT scores and high school rank? Recalling Fry's (2003) study of Hispanics in higher education, he found the observed graduation rate for Hispanics to be lower in highly selective institutions by about 7% (83% versus 89%). This is almost double the difference in the graduation rates between Hispanics and all midshipmen at the Naval Academy (74% versus 79% respectively). One may hypothesize that Hispanics are neither favored nor biased against with regard to graduating from the Naval Academy considering they are doing better than the national average even though they come to the Naval Academy with slightly lower performance in SAT score and high school grades.



***b. Personality***

How well students assimilate into the college experience has been the subject of many studies. Tinto's (1993) research in this area applies well to the Naval Academy experience. He splits the factors affecting student departure and performance into two categories: personal qualities, and interactions or integration in an academic or social context. This research found that qualitative measures, such as social integration and participation in extracurricular activities, can impact a student's decision to persist in college settings. One qualitative measure seen in many studies focusing on college age students is personality type. Assuming this characteristic is relatively stable (as previous studies have), a student's personality may prove useful in learning more about midshipmen success at the Naval Academy. Brashears and Baker (2003) concentrated their research on pre-entry college student characteristics and found that personality tests, SAT/ACT scores, high school GPA, and high school percentile rank are suitable predictors of academic success (first year GPA, cumulative GPA, and graduation).

A brief explanation of the Myers Brigg Type Indicator rating (a commonly used personality inventory) is required before any further discussion of personality type. Personality typing research began in the 1920s by Carl Jung. During the 1950s, his theories were used by Isabel Myers and Katherine Briggs to construct 16 personality categories (Berens, 2000). Since the 1950s MBTI personality types have been widely used as a means of understanding normal personality variations, rather than psychological disorders or fixed traits (*Ethical Guidelines for the Myers-Briggs Type Indicator*).

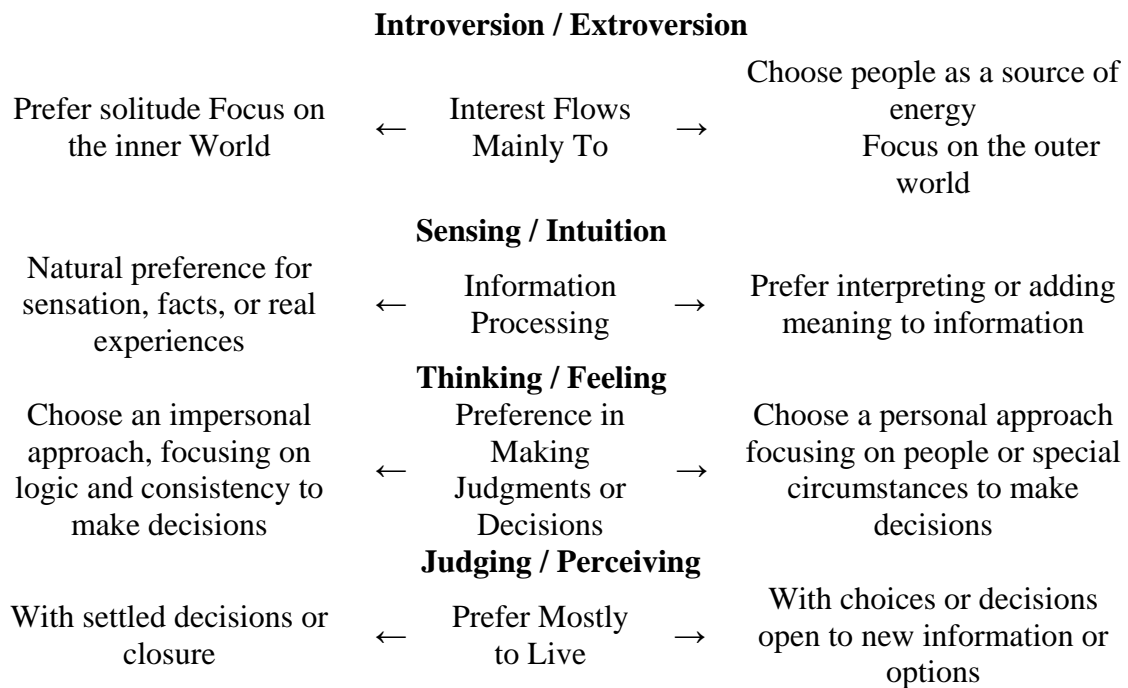
All the 16 types are defined by four letters. Below is an illustration of the differences.

**Table 1. MBTI Lettering Scheme**

<b>First Letter</b>	<b>Second Letter</b>	<b>Third Letter</b>	<b>Fourth Letter</b>
E or I	S or N	T or F	P or J
Extroversion	Sensing	Thinking	Perceiving
Introversion	Intuition	Feeling	Judging

Source: Keirsey, D. and Bates M. (1984).

The figure presented below details the defining characteristics of the eight categories identified above.



**Figure 1. Description of Eight MBTI Categories**

Other studies that focused on personality at the Naval Academy found that certain personality types have a higher likelihood of graduating. Despite the fact that The Myers Briggs Foundation espouses that there is no best type (Ethical Guidelines for the Myers-Briggs Type Indicator Instrument), research shows that some types handle the rigors of the Naval Academy with greater degrees of success. Provost's (1985) study found that midshipmen with the extroversion characteristic were more likely to graduate vice introverted midshipmen. He also found that the following four types were more likely to attrite: ISTP, ESTP, ISFP, and ENFJ. Roush (1989) and Murray (2001) studied personality types at the Naval Academy, and their findings also showed extroverted midshipmen were more likely to graduate; while, midshipmen with the Feeling or Perceiving MBTI rating were more highly associated with attrition.

In 2002, two studies revisited personality and its impact on midshipmen at the Naval Academy. Carl Burkins (2002) studied the role of personalities in minority

attrition. He found two personality types, ENFP and INFP, were significantly related to attrition of minority students (defined as non-Caucasian). Minority midshipmen that were ESTJs and INTJs were associated with a higher likelihood to graduate and this finding was statistically significant. Thomas Foster and Kamyar Pashneh-Tala (2002) found midshipmen with E, T, or J MBTI type were more likely to attrite.

To distill the results of the various studies into personality at the Naval Academy into a few themes may prove difficult for many reasons. First, some of the findings appear to contradict one another. Secondly, MBTI personality typing attempts to quantitatively explain what may be a very subjective or qualitative characteristic. But, this should not discourage its inclusion into future research. To the contrary, subjective ratings are very much a part of the admission process at the Naval Academy and have been for some time. This study will focus or least control for personality measures.

#### **D. FACTORS CONSIDERED IN ADMISSIONS PROCESS**

##### **1. Admissions Criteria at the Naval Academy**

Since 1975 the Admissions Office at the Naval Academy has used the Cumulative Multiple (CMULT) as the primary aid in selecting midshipmen (Alf, Mattson, and Neuamn, 1988; McNitt 1982). It is a numerical score assigned to all applicants (called candidates) during the application process. Its goal is twofold: to systematically evaluate candidates and predict midshipmen success. Midshipmen success is defined by the following measures: Academic Quality Point Rating or AQPR (similar to college GPA), Military Quality Point Rating or MQPR (uses the same scale as AQPR), voluntary resignation, academic attrition, and all attrition (voluntary and involuntary, no medical discharges) (Alf, et al., 1998). The cumulative multiple is composed of several predictor variables. They are: math and verbal SAT scores, a standardized high school rank, recommendations from math and english high school teachers (emrec), athletic (aecea) and non-athletic (naeca) extra curricular performance, and two scores from the Strong Campbell Interest Inventory called the Career Interest Score (CIS) and the Technical Interest Score (TIS). The CIS intends to measure one's propensity to graduate and make the Navy a career (stay in service 20 years or more). The TIS intends to measure a candidate's willingness to choose an engineering or science major.

The scores of these components are combined and weighted to form the cumulative multiple. Given the nature of the emrec component, the cumulative multiple is has quantitative and qualitative characteristics. In addition to the cumulative multiple, the Admissions Board incorporates a purely subjective rating called Recommendations of the Admissions Board or RABs. RABs are additional points (positive or negative) that can be added to a candidate's cumulative multiple. The intent of RABs is to give the Admissions Board a more accurate reflection of a candidate's potential for success by assigning a score for information within candidate's applicant package that is not reflected in the cumulative multiple. Examples may include having a parent or sibling having attended or currently attending the Naval Academy, an outstanding rating in with admissions interviewer (Blue and Gold Officer), or candidates who were participants in the USNA Engineering Summer Seminar, or Advanced Placement courses (USNA, 2002).

RABs are given to about 80% of each class' applicants and are overwhelmingly positive (very few negative RABs are given) (Foster et al. 2002, IR, 2004). When the cumulative multiple and RAB scores are added together the product is called the Whole Person Multiple (WMULT). It is the Whole Person Multiple that is used by the Admissions Board to evaluate all candidates for admission to the Naval Academy (Foster, 2002). Evaluations are made by the Admission Board and the ultimate decision to offer an appointment to an applicant resides with the Dean of Admissions according to U.S. Code, Title 10, chapter 603.

## **2. Effect of Recommendations of the Admissions Board**

RABs appear to have a different meaning to the board depending on the candidate's cumulative multiple score. If a candidate has a cumulative multiple below a minimal threshold score, often RABs are given to get the candidate to get the WMULT score above the threshold and thereby making the candidate eligible for admission. For the vast majority of cases this is the minimum score needed to be considered for admission to the Naval Academy (Foster, 2002). Typically, the lower the cumulative multiple the higher or more positive the RAB score given (IR, 2004). This group of candidates with low cumulative multiple scores also receive more RABs than candidates in the middle and high range of the cumulative multiple scores. Candidates in the middle

to high ranges also received RABs for admissions consideration; but, the majority of the RAB scores for these candidates probably reflect desirable yet unaccounted traits not reflected in the cumulative multiple score (Phillips, 2004). Phillips constructed several models to determine if RABs had any impact on midshipmen graduation, leadership positions or stripers, cumulative academic and military QPR, and order of rank. He found that after controlling for demographic characteristics, RAB scores, and athletic recruit status, African Americans and Hispanics are not doing as well as Caucasians in graduation, academic QPR, and leadership positions.

## **E. OTHER FACTORS THAT CAN EFFECT SUCCESS AT USNA**

### **1. Prior Enlisted**

In 2000, Keith Mishoe's research centered on prior enlisted midshipmen. This study established that there is some benefit to being prior enlisted at the academy. He made a distinction within the group of prior enlisted midshipmen; some had fleet experience some did not. Mishoe found that all prior enlisted midshipmen were more likely to graduate. He also found that prior enlisted midshipmen with fleet experience were more likely to assume the higher leadership positions in the Brigade during their last year. Unfortunately, there is no way to determine if this applies to gender and demographic groups equally because his study didn't control for these variables in any statistical regressions.

### **2. Military Background**

Midshipmen with military backgrounds or legacy would appear to have similar potential benefits as prior enlisted midshipmen in that they provide some exposure to military life and culture through a parent. In 1999, James Michael analyzed the impact of legacy on Naval Academy Success. After controlling for the various components of the cumulative multiple, he found midshipmen that had a parent who was a career military service member (either retired with 20+ years or were on active service during a midshipman's application to the Naval Academy) were 5% more likely to graduate, and this finding was significant ( $p < .01$ ).

### **3. Athletes**

Several studies of athletes and their success at the Naval Academy have been done. Harvey (2003) and Zettler (2002) found that athletic status was not a statistically significant predictor to academic QPR. Both studies found that SAT (math and verbal) scores were statistically significant and positively related to academic QPR; while minority status (non-Caucasian) was a significant negative predictor of academic QPR. The studies differed in their findings on military QPR. Harvey (2003) found that earning a varsity letter had no affect on military QPR. On the other hand, Zettler's findings showed varsity letter winners, club sport letter winners, individual sport's team letter winners, and team sport's team letter winners were all positive predictors of a midshipman's military QPR. His study also found that recruit athlete<sup>3</sup> status was not a significant predictor of military success. These different findings are the likely result of variations in the analytical approach of the two researchers. Harvey's control variables included gender and type of major (Engineering, Math/Science, or Humanities). Zettler's study controlled for gender, prior enlisted status, legacy midshipmen, all components of the cumulative multiple, two MBTI personality types (ESTJ and ISTJ), and if varsity athletes were recruited or not. Another study done in 1997 showed that recruited athletes had a higher likelihood (by 2.2%) to graduate than midshipmen that were either not recruited for athletics or did not play a varsity sport (Reardon, 1997).

### **4. Accession Sources for the Naval Academy**

The Naval Academy accepts the majority of its applicants directly from high school, and these future midshipmen are called direct entry candidates. The rest of the midshipmen (excluding midshipmen from other countries) come from four other sources. They are: the Naval Academy Preparatory School (NAPS), Naval Academy Foundation (Foundation), the Broadened Opportunity for Officer Selection and Training (BOOST) program, or sailors from the nuclear power education pipeline (NUKE). NAPS and Foundation are one year programs that give prospective applicants the opportunity to improve academic, physical, or other deficiencies that would otherwise keep them from matriculating directly to the Naval Academy. BOOST is a program designed to prepare

promising enlisted service members from the Navy and Marine Corps for the rigors of collegiate academics. Once a Sailor or Marine completes the program he or she would attend a college and receive a commission upon graduating. A very small number of BOOST graduates attend the Naval Academy instead of attending civilian institutions. Sailors in the nuclear power pipeline usually are in the middle of the nuclear propulsion education when they apply and are given appointments to the Naval Academy.

FitzPatrick's (2001) study tested for differences in midshipmen academic and military QPR and graduation statistics relative to their accession source. He controlled for SAT scores (math and verbal), athletic recruit status (blue chip only), high school rank, and categorized midshipmen into all the accession groups (excluding midshipmen from the NUKE pipeline). Study results found that African Americans and Hispanics (excluding Puerto Ricans) from NAPS and Foundation prep schools had significantly ( $p < .05$ ) higher academic QPR than midshipmen of like demographic groups from other accession sources. In military QPR, only Hispanics (excluding Puerto Ricans) from NAPS showed indications of doing better ( $p < .05$ ) than non-NAPS Hispanics.

The binary logistic model run in this study to predict graduation showed no statistically significant results for minorities from NAPS or Foundation prep schools with the exception of Hispanics (excluding Puerto Ricans) from NAPS. These midshipmen were 6% more likely to graduate after controlling for SAT scores, high school rank, accession source, and athletic recruit status (blue chips) (FitzPatrick, 2001).

## **5. Strong Interest Inventory**

Sheppard's (2002) study examined the impact of the components of the Strong Interest Inventory (SII) on choice of major. The SII is used as the basis for computing two components of the cumulative multiple, the Technical Interest Score (TIS) and the Career Interest Score (CIS). The TIS attempts to predict who will choose technical majors. Sheppard's study focused on the TIS and found it was negatively correlated to academic QPR. The demographic groups were Caucasian, African American, and Other (Hispanics were grouped into the Other category). It was found that midshipmen in the

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<sup>3</sup> The personality types were controlled for because these types had average academic and military QPR that were above the average. Recruited athletes are candidates that are sought out by varsity sports staff but are not given special considerations in the admissions process as blue chip recruit athletes are.

Other Category were likely to have lower performance in academic QPR after controlling for SAT scores, high school rank, teacher recommendations, athletic and non-athletic ECA scores, the TIS, and the CIS (measurement of one's propensity to make the navy a career.) (Shepard, 2002).

## 6. Stripers

Stripers are the leaders of the Brigade. They are first class midshipmen responsible for the administrative activities (formation, drill, planning, etc.) of the Brigade on a daily basis. The ranks range from zero to six stripes. For the most part, midshipmen desiring three or more stripes must first volunteer their name for consideration before competing for these billets. Below is a table detailing the rank names and the numbers of stripes associated with them.

**Table 2. Striper Ranks of First Class Midshipmen**

Number of Stripes	Rank
0	Midshipman in Ranks
1	Midshipman Ensign
2	Midshipman Lieutenant Junior Grade
3	Midshipman Lieutenant
4	Midshipman Lieutenant Commander
5	Midshipman Commander
6	Midshipman Captain

From the top, there is one midshipman with six stripes for the entire Brigade with the job title of Brigade Commander and rank of 'Midshipman Captain'. Below this billet are two regimental commanders with five stripes. Each regiment has three battalions beneath it. They are run by midshipmen with four stripes; they are called battalion commanders. Each battalion consists of five companies, each of which is administered by midshipmen with three stripes called the company commander. The company commander has four midshipmen below him or her with two stripes called platoon commanders. Finally, each platoon has four squads. Each squad consists of about twelve midshipmen who report to a first class midshipman with one stripe (squad leader at



‘Midshipman Ensign’ rank). There are more billets at the Brigade, regimental, battalion, and company level in addition to billets for sports teams, extra-curricular activities, and other activities that have stripers within their organizational structure as well.

The fall and spring semesters have different midshipmen chains of command. With the beginning of the academic year in the fall, a new of command is established. The process is repeated for the spring semester. This allows for two Midshipman Captains to lead the Brigade, one during each semester, and this applies for almost all the other billets in the rest of the striper structure. There are a few exceptions (for example, the midshipman running the Brigade Honor Staff holds his or her position the entire academic year). Fox’s (2003) study into stripers found that minorities (non-Caucasians) were 2.7% more likely to become stripers (four or more stripes) after controlling for gender, academic and military QPR, demerits, and conduct scores. Fox’s study went into much detail on the selection process for stripers including the need for an ethnically diverse group of stripers. He wrote the following passage:

The Deputy Commandant emphatically stated that he did not use, nor desire to use, any type of quota system in order to ensure diversity amongst the stripers. He simply stated, “I make sure it happens.” This is consistent with the response from the Battalion Officer, ... who stated, “...the only guidance I get [from above] is ‘diversity.’”

As a final observation of demographic distribution, the Battalion Officers were, in fact, sent back to find candidates due to an apparent lack of ethnic diversity. (2003, p. 45-46)

Then and now the vast majority of the input for selecting four stripers and above originates from officers on the Commandant’s staff. Unfortunately, in Fox’s (2003) study, data about specific minority groups was not presented; the minority variable classification was either Caucasian or non-Caucasian. This study did not focus on any pre-entry characteristics outside of gender and demographic group.

## **F. CHAPTER SUMMARY**

This chapter’s intent was to: define the term Hispanic, review their service in our nation’s military from the revolutionary war to the present day, and describe trends in higher education and performance at the Naval Academy as seen in previous studies. In

summary, Hispanics have served as long as any other demographic group in nation's defense, have excelled in higher education at highly selective institutions; yet, many Hispanics are at a disadvantage in seeking collegiate success. On the other hand, Hispanics would appear to be doing well in highly selective institutions nationwide, and appear to be doing well at least in terms of their graduation rate at the Naval Academy despite the fact that they are over represented in the lower quartiles of high school and SAT performance during the admissions process. Lastly, Hispanics have been included or at least accounted for in certain studies of midshipmen at the Naval Academy, but not to the extent they should be; given they have been the largest minority group nine out of last fourteen graduating classes from 1991 to 2004 (IR, 2004). Making predictions for how they will do compared to other demographic groups will prove difficult for many measures of success.

One the other hand, African Americans, have garnered more attention and therefore it may prove easier to predict how well they do compared to other demographic groups. Specifically, African Americans are more likely to be a senior leader their last year at the Naval Academy (Fox, 2003). Another observation to make from the literature is that, overall, Asian Americans tend to do much better in college and more of them go to selective institutions than any other group. But, the various studies done on midshipmen in the past often don't specify Asian American midshipmen in research.

### **III. RESEARCH METHODOLOGY OF QUANTITATIVE MODEL**

#### **A. INTRODUCTION**

This chapter discusses the following: source of data, data definitions (dependent and independent variables), and research design for various measures of midshipmen success. These steps are required before preliminary or descriptive analysis of the data is accomplished; which itself is a prerequisite for statistical modeling of the dependent variables.

#### **B. DATA SOURCE**

The Data Warehouse is an Oracle run database administered by The Office of Institutional Research, Planning, and Assessment (IR) at the Naval Academy. It is the single source for midshipman information in this study. Numerous files have been compiled in order to create the data set for the study. The primary key for merging the files was the midshipman's alpha code. The alpha code is a unique number assigned to all midshipmen upon admission to the Naval Academy on Induction Day (I-Day).

Data base managers from IR pulled data from the database and delivered them in the form of Microsoft Excel spreadsheets. Data were transferred to SPSS where it was then processed. Data were cleaned to remove duplicate cases, and certain variables were modified or combined for this study. Only midshipmen that are American citizens are included in the data. All foreign nationals that attend the Naval Academy were removed. The data set spans the graduating classes of 1999 to 2004. It consists of 7127 midshipmen who graduated and also those that attrited. It must be noted that not all of the midshipmen in the data base were used in the models. Unfortunately, some of the midshipmen did not have some of the variables needed for statistical modeling. Hence, these midshipmen were excluded from some of the regressions. This has the effect of decreasing the sample size, and is accepted as a limitation in this study.

#### **C. DESCRIPTION OF DATA**

The data include pre-entry characteristics (demographics and high school performance) obtained by IR during the application process and midshipman performance information as measured by four dependent variables.

## **1. Dependent Variables**

There are four dependent variables used in this study that define midshipmen success, including:

- Graduation
- Leadership (four stripes or above in Brigade rank structure)
- Average military performance grade
- Cumulative academic QPR or CAQPR.

### ***a. Graduation***

Graduation was chosen because of its finality in terms of what the Navy expects from the Naval Academy; either one graduates and serves in the fleet (with rare exceptions) or does not. It is a dichotomous variable with the value 30 given to attrites and the value 40 given to graduates. A midshipman graduate must have met the basic requirements to graduate without regard to being commissioned in Navy, Marine Corps, Army, Air Force, or Coast Guard (a small but constant number of graduates seek and obtain commissions outside the Navy and Marine Corps). There are 13 midshipmen in the data set that met the graduation requirements yet were not physically qualified. These midshipmen were retained in the study in order to prevent further reduction in sample size. Overall, the graduation rate for midshipmen from the classes of 1999 to 2004 is 79.5%.

### ***b. Leadership***

Leadership is measured in this study by the *striper* variable. It is a dichotomous variable and splits all first class midshipmen into two separate categories. The value of 0 is given to midshipmen that never had a *striper* position above four stripes; while a value of 1 is given to midshipmen that were four *stripers* or higher. Because the rank structure changes at the beginning of the spring semester, midshipmen have two ranks for their last year. The highest rank from both semesters was used to determine the leadership score the first class midshipmen. Of the 4,817 midshipmen in the data set the vast majority of them were three *stripers* and below. Only 4.8% were four *stripers* or higher. The split at the three to four *stripe* level was used because a previous study, a

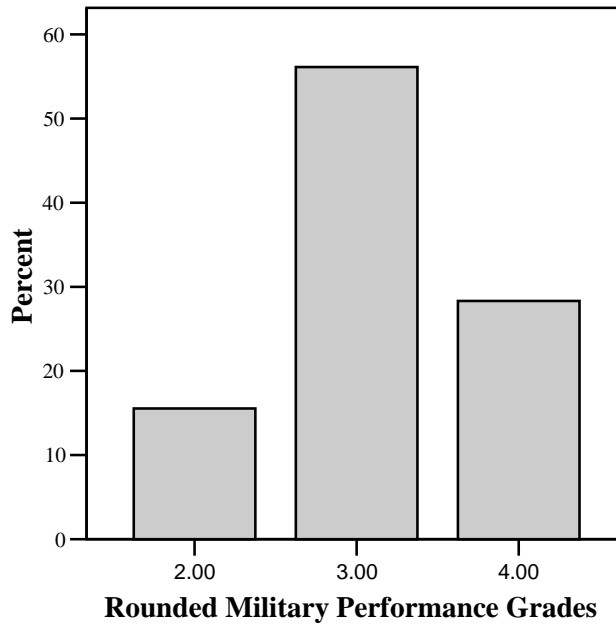
1993 GAO report, Naval Academy: Gender and Racial Disparities, made the same split in attempts to learn more about the higher ranking leaders of the Brigade.

***c. Military Performance Grade***

Each semester midshipmen are assigned a military performance grade. Possible grades to be given are: A (4.0), B (3.0), C (2.0), D (1.0), or F (0.0) (COMDTMIDNINST 1600.2B, 2003). Before the spring 2003 semester, company officers were the sole arbiter of the grade. Now, company officers continue to enter the military performance grades; but, are required to review midshipmen assessments of their peers and underclass midshipmen as well. The differences in how the grade was determined over time may confound this portion of the study. What has not changed is the significance of the grade. It weighs heavily on midshipman military QPR, making up about 40% of the one's semester cumulative QPR or CMQPR. For this study, most cases of graduate midshipmen had eight military performance grades. These were averaged and rounded to the nearest whole number. This variable has values of 2, 3, or 4. The table and figure below shows the distribution of this variable for all first class midshipmen.

**Table 3. Rounded Military Performance Grade**

Grade	Frequency	Percent
4.0 / A	1404	29.3
3.0 / B	2669	55.7
2.0 / C	718	15.0
Total	4791	100.0



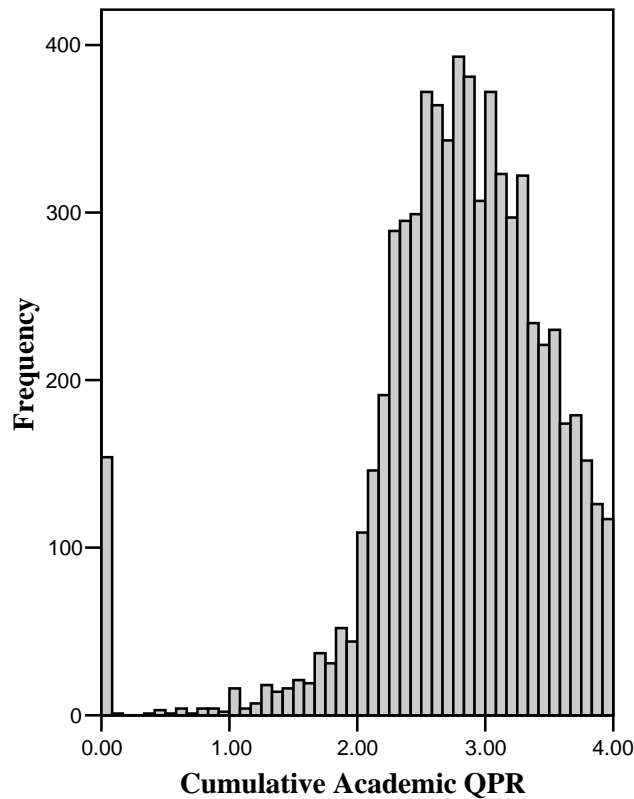
**Figure 2. Rounded Military Performance Grades**

The distribution is skewed to the higher side (A and B grades) showing the highest frequency for a military performance grade of a 3.0.

***d. Cumulative Academic Quality Point Rating***

The overall academic performance of midshipmen is represented by the cumulative academic QPR or cumaqpr. It is a continuous variable ranging from 0.00 to 4.00 with a 2.0 being the lowest score a midshipman can have to graduate, and is the equivalent of one's GPA in a collegiate or high school setting.

For the statistical regressions, this dependent variable will remain a continuous variable. Doing so keeps intact the worth this variable has, given that it is the most influential factor in determining order of merit midshipmen. It also makes it easier to interpret model results against changes in certain independent variables such as SAT scores and high school rank (also continuous variables). The distribution of this variable is illustrated in the histogram below.



Mean = 2.81 Std. Dev = 0.70 N = 6,690

**Figure 3. Distribution of Mean Cumulative AQR**

Even though the histogram shows values below 2.00, midshipmen are required to have a cumulative academic QPR of a 2.00 or higher in order to graduate. The spike at 0 is due to midshipmen that attrited the first semester of Plebe year, before an academic QPR was ever calculated.

## **2. Independent Variables**

Previous studies of midshipmen performance have found certain variables to be of value in modeling for midshipmen success. It is important to note that there are many factors contributing to midshipmen success and that this study intends to look into only some of them. The following variables were chosen based on the literature review's summary of past studies on midshipmen and collegiate students. With the exception of personality classifications, all the variables have been used in prior research of midshipmen. The independent variables are partitioned into three groups:

- Control Variables (gender, demographic group, class year)
- Quantitative Variables (prior enlisted, legacy, accession source, athletic recruit, SAT scores, high school rank, components of candidate multiple (excluding teacher recommendation scores))
- Qualitative Variables (teacher recommendation scores, RAB impact, personality type)

*a. Control Variables*

(1) Demographic Group. Institutional Research (IR) has more categories that all fall under the variable Ethnic Code than this study desired for analysis. Thus, several categories were combined. One should keep in mind that the IR data were self reported; so this information is subject to the candidate's interpretation of what membership in one category means. The following table shows how midshipmen were be classified for this study with regards to the racial, ethnic, or group affiliation. The table below gives the names of the categories used in the study and how they were segregated from the codes used in the original data set. The definitions for each category are the same as those used by the Office of Management and Budget. All demographic groups are dummy coded into separate dichotomous variables for statistical regressions. For example, a midshipman reporting their ethnicity as Mexican would be codes as '1' for Hispanic and '0' for the other four demographic categories (Caucasian, African American, Asian American, and Other).



**Table 4. Demographic Groups of the Brigade**

	<b>Definition</b>	<b>Number</b>	<b>Percent</b>
Caucasian*	A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.	5774	81.0
African American	A person having origins in any of the black racial groups of Africa. Terms such as "Haitian" or "Negro" can be used in addition to "Black or African American."	445	6.2
Hispanic**	A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race. The term "Spanish origin" can be used in addition to "Hispanic or Latino."	534	7.5
Asian American ***	A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.	296	4.2
Other	Midshipmen that are not affiliated with any of the above groups	78	1.1
	Total	7127	100.00

\* OMB uses the term White. IR uses the term Caucasian. The Merriam-Webster Online Dictionary defines Caucasian as of, constituting, or characteristic of a race of humankind native to Europe, North Africa, and southwest Asia and classified according to physical features -- used especially in referring to persons of European descent having usually light skin pigmentation. For this study both terms will be used interchangeably.

\*\* Midshipmen classified as Puerto Ricans by IR are included in the Hispanic category

\*\*\* Midshipmen classified as Filipino by IR are included in the Asian American category  
Source for midshipmen data: Institutional Planning, Research, and Assessment, 2004.

Minorities (non-Caucasian) have been attending the Naval Academy in appreciable numbers for some time now. The frequencies of the demographic groups over the six class years in the dataset are in the table below.

**Table 5. Demographic Group vs. Class Year**

	Class Year					
	1999	2000	2001	2002	2003	2004
Caucasian	79.8%	81.7%	79.6%	82.2%	80.8%	81.8%
African American	7.5%	6.1%	6.6%	5.1%	6.7%	5.9%
Hispanic	7.5%	7.1%	8.6%	6.9%	7.6%	7.2%
Asian American	3.5%	4.3%	4.2%	4.8%	3.9%	4.0%
Other	1.8%	0.8%	1.0%	1.0%	1.0%	1.2%

Pearson Chi-Square: 19.3

Sig (2 tailed): .501

Source: Institutional Planning, Research, and Assessment, 2004.

There are certain trends in Table 5 worth mentioning. First, the percentage of Hispanics has risen and fallen during the six years covered by this study; ranging between a low of 6.9% and a high of 8.6%. Hispanics outnumbered African American midshipmen in the Brigade, and by the class of 2004, Hispanics outnumbered African Americans by 1.3%. Representation for Caucasian, Asian American, and Other midshipmen demographic groups appear stable. The Ch-Square statistic and significance for the data in the table indicates that any year to year variations in demographic composition of the midshipmen in the data set is random.

(2) Gender. Unlike civilian institutions of higher learning, women make up only about 17% of each graduating class in the dataset, and they tend to attrite at a higher rate. Therefore gender, as a variable, should be used in the graduation models. For the sake of consistency, gender will be used in the striper, military performance and cumulative academic QPR models; but, it is not the primary variable of interest to this study. The table below shows the distribution of women in the dataset by class year.

**Table 6. Gender Composition by Class Year**

Class	Gender (%)		Total
	F	M	
1999	16.8	83.2	100.0
2000	16.4	83.6	100.0
2001	18.2	81.8	100.0
2002	15.4	84.6	100.0
2003	16.6	83.4	100.0
2004	16.8	83.2	100.0
Total	16.7	83.3	100.0

Source: Institutional Planning, Research, and Assessment, 2004.

(3) Class year. Class year is included in this study to minimize fluctuations or changes in mean scores of the dependent variables; changes that would otherwise be incorporated in the coefficients of other independent variables. The following table shows the distribution of midshipmen in the dataset by class year.

**Table 7. Distribution of Midshipmen by Class Year**

Class Year	n	Percent
1999	1140	16.0
2000	1189	16.7
2001	1157	16.2
2002	1218	17.1
2003	1217	17.1
2004	1206	16.9
Total	7127	100.0

Source: Institutional Planning, Research, and Assessment, 2004.

***b. Quantitative Variables***

(1) Prior Enlisted. Prior enlisted status is represented in the data set as a dichotomous variable that gives the value of 0 for midshipmen that have no prior enlisted experience, and the value of 1 for midshipmen that have any prior enlisted experience with one exception. One needs to make a distinction with midshipmen that attended the Naval Academy Preparatory School (NAPS). Even though all ‘NAPSters’ are enlisted, only those at NAPS that were previously enlisted are classified as prior

enlisted in the data. The other NAPSters are not prior enlisted for the purposes of this study because they have not been inculcated in the enlisted culture from the fleet or the other services. The table below shows the breakdown for this variable.

**Table 8. Prior Enlisted Midshipmen**

	<b>Number</b>	<b>Percent</b>
Non Prior Enlisted	6601	92.6
Prior Enlisted	526	7.4
Total	7127	100.0

Source: Institutional Planning, Research, and Assessment, 2004.

(2) Legacy. Legacy midshipmen are defined in this study as midshipmen that have or had a parent serving in the military upon applying to the Naval Academy. It is a dichotomous variable that gives the value of 0 to midshipmen that are not legacy midshipmen and the value of 1 to those that are. The following table shows the frequency

**Table 9. Legacy Midshipmen**

	<b>Number</b>	<b>Percent</b>
No Legacy	4187	58.7
Legacy	2940	41.3
Total	7127	100.0

Source: Institutional Planning, Research, and Assessment, 2004.

(3) Accession Source. IR records where a midshipman comes from before I-Day in a variable called feeder. Midshipmen can come to the Naval Academy directly from high school or college, or the fleet (without intermediary stops). These midshipmen are grouped under the direct category labeled X. Those from NAPS are labeled N, midshipmen from the BOOST program are assigned the letter B, F is given to midshipmen from the Foundation program. Lastly, midshipmen from the nuclear training pipeline are apart from other prior enlisted midshipmen and given the label K. All these sources are then given their own dichotomous variable. A value of 1 denotes a midshipman came from a particular source, a value of 0 means the midshipman came

from one of the other four sources. The table below shows the structure of the Brigade with regard to accession source.

**Table 10. Accession Sources for Midshipmen**

Source	Number	Percent
Direct	5508	77.3
NAPS	1071	15.0
Foundation	434	6.1
Nuke	92	1.3
BOOST	22	0.3
Total	7127	100.00

Source: Institutional Planning, Research, and Assessment, 2004.

(5) Athletic Recruits. There are two types of recruited athletes at the Naval Academy. One type, called recruits, are sought by the varsity athletic team staffs in hopes of finding candidates that meet the rigorous entrance standards of the Naval Academy and can contribute to the athletic programs as well. Other candidates are called ‘blue chip’ recruits, and these candidates are given some consideration due to the benefit they could bring to the Academy as a talented athlete; so they may be eligible for review by the Admissions Board. The table below details the variables to be used in this study. It has two sections; the first gives frequencies by gender. The second gives frequencies by gender and overall dataset composition. Not all the midshipmen in the data set had known status with regard to athlete recruiting. This is reflected in the total number (7117) for this table being less than that of the total data set (this occurs with subsequent variables as well).

**Table 11. Athletic Recruits by Gender****% Within Each Gender Group    % of Total Dataset by Gender**

	<b>Male</b>	<b>Female</b>	<b>Male</b>	<b>Female</b>	<b>All</b>
Not Recruited	71.9	59.5	59.9	9.9	69.8
Recruited	11.0	20.6	9.2	3.4	12.6
Blue Chip Recruit	17.1	19.9	14.2	3.3	17.5
Recruit sub total	28.9	40.5	23.4	6.7	30.1
Total	100.0	100.0	83.3	16.6	99.9

Source: Institutional Planning, Research, and Assessment, 2004.

The majority of midshipmen are not recruited (69.8%); but, women are more likely than men to be recruited for a varsity sport (40.5% for women versus 28.9% for men). Because the ratio of males to females is about six to one and because there are more recruited females than males, this study has constructed the athletic recruit variable into the following six categories:

- Male Not Recruited
- Male Recruited
- Male Blue Chip Recruit
- Female Not Recruited
- Female Recruited
- Female Blue Chip Recruit

By making six categories, more is hoped to be learned about the interactions of gender and recruited midshipmen even though they are not the primary focus of this study.

(6) SAT. The SAT is a measure of the critical thinking, mathematical reasoning, and writing skills that students need to do college-level work (Meet the SAT). There are two parts to the SAT (math and verbal), each having its own

score. Candidates that take the ACT have the score undergo a conversion into the SAT scale. The minimum score is 200 and the highest score is 800. The table below shows the mean and standard deviation of midshipmen SAT scores (aggregated across the six years in this study) against the national population of college bound seniors in 2004-05.

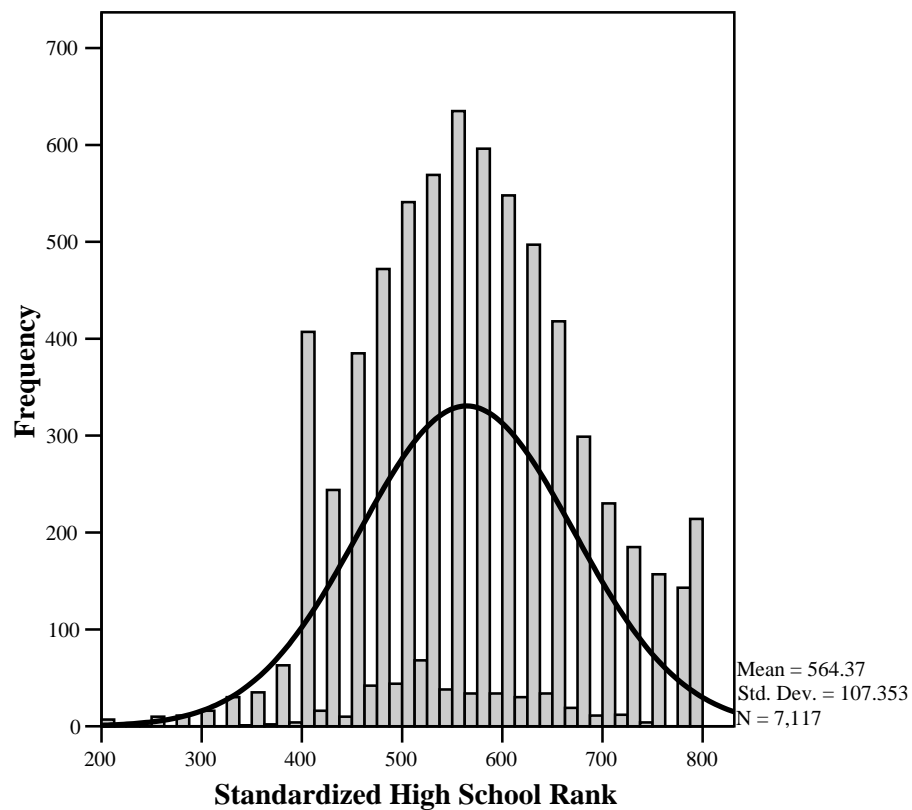
**Table 12. SAT Scores of the Brigade and College Bound Seniors**

	Midshipmen		National Scores	
	Math	Verbal	Math	Verbal
Average	662	635	518	508
Standard Deviation	63	66	114	112
n	7127	7127	n/a	n/a

Source: Institutional Planning, Research, and Assessment, 2004; SAT Program Handbook 2004-2005

Table 12 shows that the Naval Academy screens the incoming candidates based on their SAT scores. Both the math and verbal scores are above the national average and the standard deviations are smaller as well. These data point to the selective nature of the application process at the Naval Academy. The minimum scores (waivers are possible) for the SAT is 600 for both math and verbal (Admissions Board Overview, 2004).

(7) High School Rank. This is a standardized score based on an individual's high school rank and ranges between 200 and 800 (Alf, et al., 1988; Wahrenbrock & Neumann, 1989). The mean is 564 and standard deviation is 107. This score attempts to equalize a candidate's high school performance due to educational differences attributed to home schooling, high school size, location, or when high school records are not readily available (prior enlisted midshipmen) (C. Morgan (of IR), personal communication, January 7, 2005). The figure below shows that standardized high school rank for this dataset approximates a normal distribution.



**Figure 4. Standardized High School Rank**

Another point to make about high school rank is that, over time, the Naval Academy is not receiving the raw data for calculating the standardized high school rank from candidates, their parents, or their high schools at the same rate as in times past. This trend is shown in Table 13 below.



**Table 13. Cases of Midshipmen missing high school size and rank information by year.**

Class Year	Midshipmen per Class	Midshipmen with HS rank data	Midshipmen missing HS rank data	% missing HS rank data
1999	1140	1015	125	11.0
2000	1189	1040	149	12.5
2001	1157	982	175	15.1
2002	1218	1008	210	17.2
2003	1217	1017	200	16.3
2004	1206	1000	206	17.1

Source: Institutional Planning, Research, and Assessment, 2004; SAT Program Handbook 2004-2005

Year after year the percent of candidates having their high school size and their high school rank withheld from the Naval Academy is increasing. So, one of the best, if not the best predictor of success (persistence through first year of college, first year GPA and graduation) may not be readily available. In years past the majority of candidates that did not have their high school rank reported to the Admissions Board were mostly prior enlisted candidates that did not have the information easily accessible to give to admissions in the application process. Today, the increase might very well be that, because high school rank or high school performance is such a good predictor, it takes the form a double edge sword. Candidates may wish not to report their scores because the score is not very good to begin with.

(8) Athletic Extra Curricular Activity (ECA) and Non-Athletic Extra Curricular Activity Score. Athletic and non-athletic ECA participation is measured by the Admissions Board and used in the cumulative multiple (composite score of various measures or tests and the primary screening tool used in the admissions process). Both scores are derived from a questionnaire candidates must fill out in the application process. It is an objective rating ranging from 300 to 800. No minimum score is required (unlike SAT scores). Table 14 illustrates the average, standard deviation, and numbers of cases with information for this variable.

**Table 14. Athletic and Non-Athletic ECA Scores of the Brigade**

	Athletic ECA	Non Athletic ECA
Average	570	538
Standard Deviation	95	105
n	6121	6121

Source: Institutional Planning, Research, and Assessment, 2004.

(9) Career Interest Score and Technical Interest Score. The CIS (Career Interest Score) is designed to predict one's propensity to graduate and make the Navy a career (stay in service 20 years or more) while the TIS (Technical Interest Score) is designed to predict a candidate's willingness to choose an engineering or science major. Both are derived from the Strong Campbell Interest Inventory questionnaire administered to candidates in the application process. The mean, standard deviation, lowest, and highest scores for the CIS and TIS are given below.

**Table 15. CIS and TIS Scores of the Brigade**

	<b>CIS</b>	<b>TIS</b>
Average	492	495
Standard Deviation	98	95
Lowest	102	204
Highest	794	764
N	7126	7126

Source: Institutional Planning, Research, and Assessment, 2004.

The mean and standard deviation for both scores match closely with the intended means and standard deviations sought when the scores were first introduced ( $\mu = 500$  and  $\sigma = 100$ ) (Wahrenbrock et al., 1989).

**c. Qualitative Variables**

(1) High School Teacher Recommendations. This score is based on english and math high school teachers' estimates of the individual's potential for success as a naval officer. The teachers are asked to evaluate the candidate on effective communication skills, interpersonal relations, personal conduct, and leadership potential (Alf, et al., 1988). In some cases others fill out these forms. For example, a prior enlisted midshipman is likely to have two commissioned officers as the originators for the comments represented in the score (Steps for Admission). The range for this score is from 0 to 1115. The table below shows the mean, standard deviation, low, and high scores.

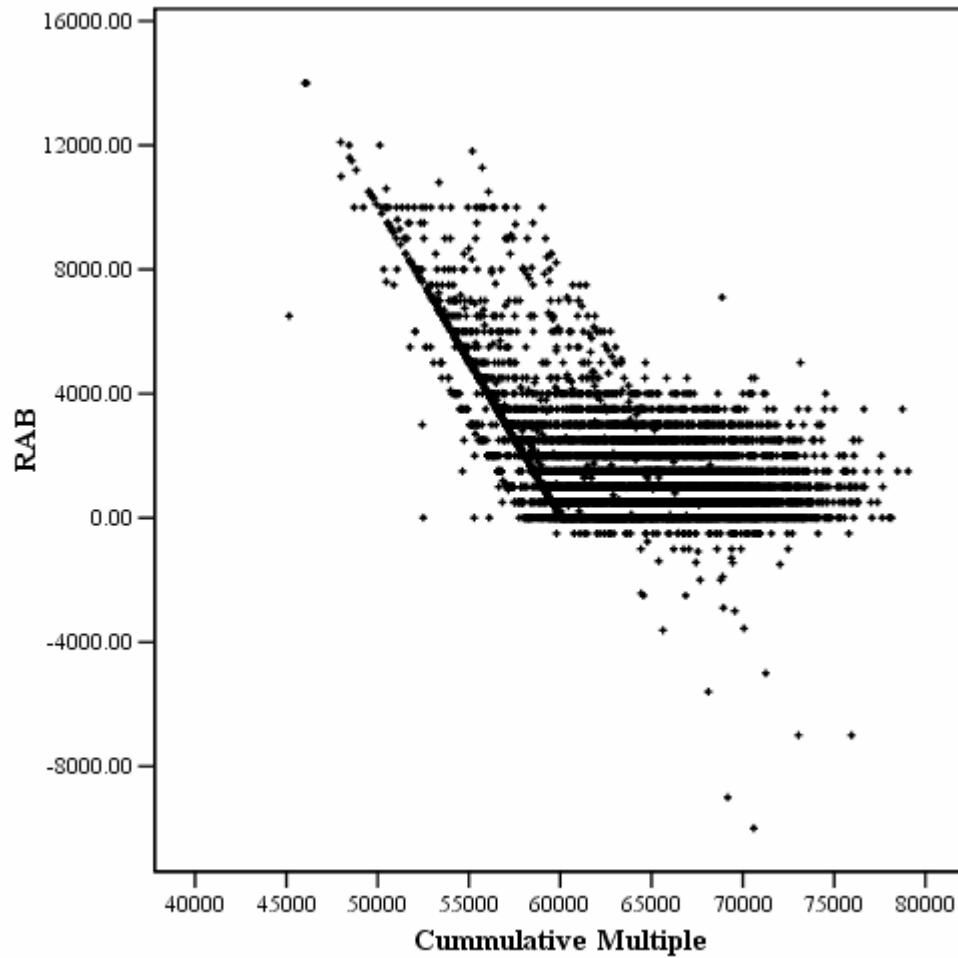
**Table 16. EMREC Scores of the Brigade**

	EMREC
Average	878
Standard Deviation	104
Lowest	492
Highest	1115
N	7127

Source: From Institutional Planning, Research, and Assessment, 2004.

(2) Impact of Recommendations of the Admissions Board (RABS).

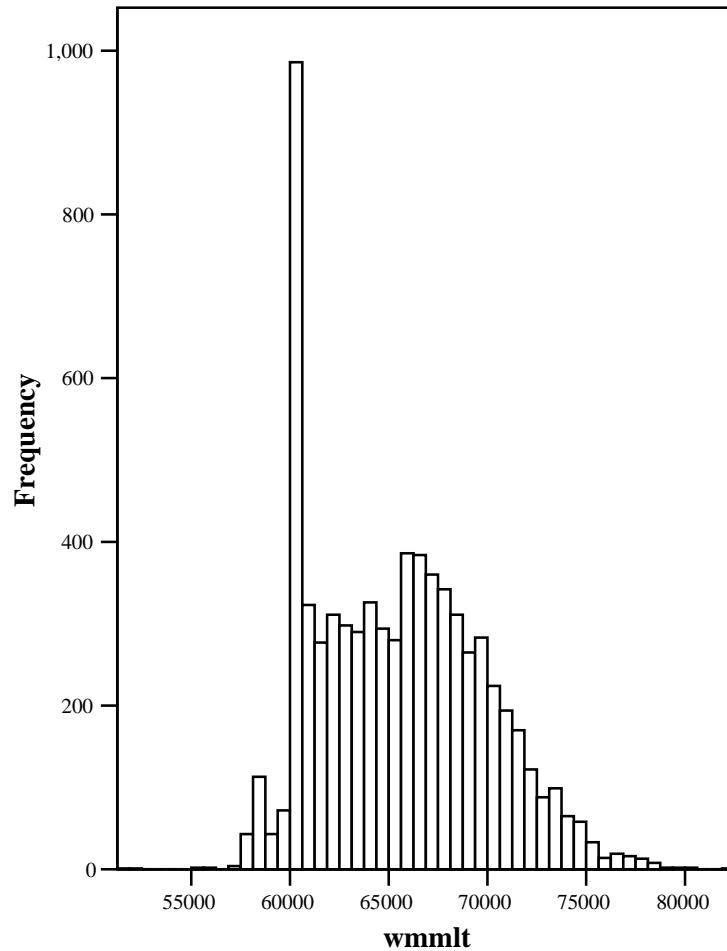
Informal interviews with Professor W. Bowman of the Naval Academy Economic Department (personal communication, January, 2005) and Dr. L. Mallory (personal communication, January 7, 2005) stressed that the method and value of RAB scores (a qualitative assessment of a candidate that has not yet been measure in the application process) varies in many ways. Firstly, RAB scores are given to candidates by the Admissions Board, whose members change over time. Additionally, as seen in Philips' (2004) research, RAB scores appear to be distributed in different ways depending on the cumulative multiple of a candidate (the cumulative multiple is a composite score of various quantitative measures (e.g. SAT) available to the Admissions Board during the application process). The figure below illustrates the relationship between a candidate's cumulative multiple and RAB score.



Source: From Institutional Planning, Research, and Assessment, 2004.

**Figure 5. Cumulative Multiple versus RAB Scores**

Philips (2004) found that candidates tend to receive higher RAB scores the lower their cumulative multiple score is. This allows candidates with low cumulative scores to meet a minimum threshold whole person multiple required to be considered a qualified candidate; one eligible for admission to the Naval Academy. Those with lower scores are 'high risk' candidates who are admitted with a superintendent's nomination. A histogram of the Whole Person Multiple (the sum of the candidate multiple and a candidate's RAB score) is shown below.



**Figure 6. Whole Person Multiple of Midshipmen**

Aside from the spike at around 60,000 the distribution of the whole person multiple approximates a normal distribution. This spike exists because admissions board members attempt to award RAB scores for candidates that generates a whole person multiple above the minimum required score needed for an appointment to the Naval Academy.

Another important characteristic about RAB scores is, that over the years, more candidates are receiving RAB scores and the average RAB score is also increasing. The following table shows in detail the upward trend.

**Table 17. RAB Score Awarded and Average RAB score by Class Year**

Class Year	% Awarded RAB Score	Average RAB Score
1999	68.9	1795
2000	74.7	2081
2001	76.2	2193
2002	80.4	2118
2003	86.6	2284
2004	88.0	2065

Source: Institutional Planning, Research, and Assessment, 2004.

From 1999 to 2004, the percent of admitted candidates that received RAB scores in the application process increased about 20% and the average RAB score also increased (with some years showing a slight decrease). But, overall the trend is positive.

Because RAB scores are awarded in differing amounts according to a candidate's cumulative multiple score, this study will attempt to differentiate the impact of RABs across the cumulative multiple spectrum by splitting those who receive RAB scores into eight groups. The table below details the range of the cumulative multiple scores (divided by 1000) in each RAB category, the mean RAB score, the number in the given cumulative multiple range who were not given a RAB score, and the minimum and maximum score in the category. Ideally 12.5% of the data set would be in each group. However, this study has made the first group slightly larger to include all candidates with a cumulative multiple less than 58,000; it has 12.7% of the data set and the second group (with 12.3% of the data set) has a cumulative multiple range beginning at 58,000. All subsequent groups have 12.5% of the cases in the data set. For ease of use, the raw RAB score has been divided by 500 and rounded to the nearest whole number. Originally the range spanned from -10,000 to 14,000; the new range has a low value of -19 and a high value of 28.

**Table 18. RAB Categories**

<b>RAB Category</b>	<b>CMULT/1000 Range</b>	<b>No Mean</b>		<b>Minimum RAB Score</b>	<b>Maximum RAB Score</b>	<b>n ( %)</b>
		<b>RAB Score</b>	<b>RAB Score</b>			
1	45.5 – 57.9	4	9.3	0	28	905 (12.7%)
2	58.0 – 60.2	134	3.4	-1	19	875 (12.3%)
3	60.3 – 62.2	279	2.7	-1	15	892 (12.5%)
4	62.3 – 63.9	275	2.5	-1	12	891 (12.5%)
5	64.0 – 65.6	200	2.6	-7	10	890 (12.5%)
6	65.7 - 67.3	184	2.2	-5	9	891 (12.5%)
7	67.4 – 69.6	188	2.0	-18	14	893 (12.5%)
8	69.7 – 79.0	230	1.8	-19	10	890 (12.5%)

Source: Institutional Planning, Research, and Assessment, 2004.

The table above shows that candidates in the lower cumulative multiple ranges are given more RAB scores and tend to have higher values versus candidates with higher cumulative multiple scores. But, RAB scores are given throughout the cumulative multiple range. This study will include RAB categories as control variables hoping to extract any influence they may have on midshipmen success that would otherwise be attributed to something else.

(3) Personality. This study will be unique from ones past in that it will use a personality measurement based on groups of MBTI personality categories instead of the 16 types derived by the Myers Briggs Foundation. The four temperaments developed by David Keirsey will used. Before presenting information of the four types and their frequency at the Naval Academy a brief description of each one is required.

“Guardians” include the following MBTI types: ISFJ, ESFJ, ISTJ, and ESTJ; all have the SJ characteristic of the MBTI types. The primary quality of this group is a strong longing for duty (Keirsey, 1984). They are caretakers and not the cared fore. Guardians must belong to some group, and this group membership must be earned. Keirsey’s following passage sheds light on the Guardian Temperament.

Above all else, indeed, the SJ is prepared. Many of his actions are preparations for those setbacks and untoward events that are bound to

occur. We must not conclude that the SJ is gloomily forecasting calamity and disaster – though Chicken Little was clearly an SJ; rather, we should see him as being realistic about error and shortages. (p. 41)

Guardians also have a strong desire for tradition and heritage, and this preference grows with age. They enjoy being members of institutions that allow them to exercise some sense of conservation or protection along with giving them the room to nurture the institution's custom and culture. Some of the institutions that Guardians gravitate towards are middle management and civil service posts. Keirsey offers another telling description of Guardians that seems to describe the current military culture, with much of the force involved in non-combat related missions (Tsunami relief, peace keeping in Bosnia and other regions).

Ironically, the SJ's tendency to be responsible does not always gain him well-deserved appreciation. People who have benefited most from the SJ's contributions may turn away, even while taking advantage of his willingness to do more than his fair share. (p. 45)

This type constitutes the largest of the four temperaments at the Naval Academy, and of all the types appears most in concert with military culture. Although little research has been done on military culture, it can be defined, at least partially by the following: service, duty, sacrifice, preparedness, and tradition.

Nicknamed as strategists in some circles, "Rationals" share the NT characteristics of the MBTI personality rating. The four types are INTJ, ENTJ, INTP, and ENTP. Rationals compose one of the smallest groups out of the four temperaments (Keirsey, 1984). But, at the Naval Academy, they make up approximately 29% of the midshipmen from the classes of 1999 to 2004; making them the second largest group (IR, 2004). Rationals are theory oriented, skilled in long range planning, inventing, and designing. Engineering and technology are occupational fields to which Rationals gravitate. They are an organization's foremost visionaries seeking to contribute their insights into organizational structures. Rationals use their constant sense of skepticism to introduce unconventional or insightful changes for the betterment of their organizations. Others see them as competent, yet they are often seen as detached from others in intellectual ways (Berens, 2000).



“Idealists” share the NF typing and are made up of the following four MBTI types: ENFJ, INFJ, ENFP, and INFP. They value meaningful relationships, are enthusiastic, and diplomatic. Idealists believe in the fundamental goodness of mankind and give much value in exploring their feelings and emotions. While not selfish, Idealists seek fame, or personal impact upon their surroundings. As such, they may appear as the leader in group formation situations or interactions. They prefer environments that recognize their uniqueness, but are uncompetitive at the same time. Idealists have a gift for communicating and a strong desire to find harmony in life for themselves and others. Additionally, Idealists value authenticity and integrity in people, relationships, and organizations. They are great communicators, gifted in process of reflection, and can anticipate unspoken issues of the individual or group (Berens, 2000). A phrase that describes Idealists well might be, “live and let live.”

“Artisans” consist of ISTPs, ESTPs, ESFPs, and ISFPs. They are the free spirits of society. Ideally, all four of the MBTI types do not want to be tied down, bound, confined, or obligated (Keirsey, 1984). Artisans love action and living in the now. They do not give much thought to the future; planning for or anticipating it. They find adventure wherever they can, trust their instincts and their ability to solve problems. Artisans desire autonomy, “tactical one-upsmanship ... and camaraderie with those who play on the same ‘team’” (Berens, 2000, p. 10).

Artisans feed off of crises or situations where the outcome is not known because both afford them the latitude to be free in testing the limits of what is possible. They are unique from the other temperaments in that Artisans harbor certain qualities that appear to fit well with military life and others that do not. Having a keen sense of observation, Artisans use this skill in predicting the actions others may take in the short term. Because of this, Artisans can make gifted tacticians, ready to seize opportunities and achieve the impossible. While they admire courage and love adapting to situations, Artisans do not like uneventful routines, restraint, and strict adherence to procedures (Berens, 2000). These last three characteristics have been used many times to describe much of what life in the military is like (at least when not in combat).

The raw data from IR contained 16 MBTI types that were then combined according to Keirsey’s four temperaments. Each temperament has its own

dichotomous variable; a value of 1 denotes a midshipman who falls in the particular temperament, and value of 0 means the midshipman's temperament is one of the other three. It should also be noted that the MBTI test is administered soon after midshipmen arrive to the Naval Academy; and as such, it not technically a pre-entry characteristic. However, for purposes of this study, it is assumed that personality is relatively stable and constant and thus qualifies as a pre-entry characteristic for this study. The table below shows the frequency of temperaments found in midshipmen. Just as the data set does not have information on all the midshipmen's athletic recruit status, not all the midshipmen have a temperament. One hundred ninety two midshipmen had missing data regarding MBTI type thus making it impossible to know their temperament.

**Table 19. Keirsey Temperaments Amongst the Brigade**

<b>Temperament</b>	<b>Number</b>	<b>Percent</b>
Guardian	2892	41.7
Rational	2031	29.3
Idealist	1008	14.5
Artisan	1004	14.5
Total	6935	100.0

Source: Institutional Planning, Research, and Assessment, 2004.

While Guardians do not constitute a majority, they are the largest group. One can not help but wonder if the Guardian temperament is more attracted to military service, as it is to other service oriented professions compared to the other temperaments (Keirsey, 1984). Given they are the largest group it might also be that they identify more closely with the military culture or that the military culture is more aligned to them than the other three. It must be mentioned again that this study is including a variable based on a typing system that stresses there is no type inherently better or worse than another. MBTI types (and therefore the derived temperaments) points to one's tendencies and not absolute or fixed behaviors. The types do not imply any degree of excellence, competence, or natural ability. Putting people into categories of this nature should be avoided (Ethical Guidelines for Myers Briggs Type Indicator Instrument). Nonetheless, studies have used MBTI types in the past. Recommendations based on findings should be made with caution as should any action stemming from recommendations.

## **D. RESEARCH DESIGN**

This section discusses the structure of the models to be used in this study. First presented is a brief description of the types of regression models to be used. Next, a description of the model specifics for each dependent variable is detailed.

### **1. Types of Models**

#### ***a. Ordinary Least Squares***

The ordinary least squares (OLS) technique is used for cumulative academic QPR (cumaqpr). This dependent variable is continuous ranging from 0.00 to 4.00. The regression equation will take the following form:

$$Y' = A + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + e$$

$B_k$  represents the un-standardized coefficient for any of the independent variables  $X_k$ . It represents the estimated impact (holding all else constant) a given independent variable has on the outcome. A larger coefficient means a small change in a particular independent variable equates to a larger change in the dependent variable (cumapr). For the purposes of this study, the un-standardized coefficients will be used to analyze the findings. In so doing, one can compare the results from this type of model with the marginal effects of the binary logistic models.

#### ***b. Binary Logistic Models***

The models for graduation rate, and leadership positions are similar in that both have only two outcomes. One either graduated or not, and one either attained four or more stripes or not. The independent variables used in both are a combination of continuous, discrete, and dichotomous variables. Logistic regression models are well equipped to handle this variety in types of data. The logit coefficients generated are not comparable with the un-standardized coefficients generated by an ordinary least squares (OLS) linear probability model. However, marginal coefficients can be calculated that have the same interpretation as the beta coefficients in an OLS model. The marginal effect represents how much impact or change (represented in percent of change) that a particular independent variable has on a dependent variable.

As for military performance grades: scores may be an A, B, or C. Instead of an ordered logistic mode that is normally used when the dependent variable has few

discrete values and order is meaningful, the study approximates these outcomes by running two independent binomial logistic regressions: the first modeling the A grade (yes = 1; no = 0) and the second model the C grade (yes = 1; no = 0). Marginal effect coefficients are calculated and approximate those that could be derived from the more complex ordered logistic model.<sup>4</sup> Instead of using one multinomial logistic model that generates data for two of the three possible scores, a battery of binary logistic models are used to predict which midshipmen are likely to receive an 'A' or 'C' grade.

*c. Model Limitations*

Each regression generates coefficients that are supposed to represent the overall relationship between independent and dependent variables. Unfortunately, complex interactions revealed in Chapter III (between some components of the cumulative multiple and dependent measures) may not be reflected in the model results of Chapter V. A coefficient from an OLS or binary logistic model reflects linear relationships; but some of the observed relationships are not, thus explaining non linear relationships with these models may prove difficult.

**2. Modeling Specifics**

Each measure of midshipmen success represented as a dependent variable in this study will be analyzed with three statistical regression models. The first model will include demographic groups, gender, and class year as the independent variables. The second model will include variables of the first model in addition to quantitative variables found in the cumulative multiple, and other variables not included in the cumulative multiple but that are considered by the Admissions Board. The third model will build on the second and include the qualitative variables discussed above. The split in variables between the second and third models is done so one can compare what, if any, benefit qualitative variables add to the predictive ability and overall robustness of the preceding models.

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<sup>4</sup> The author did not have access to specialized software to convert logistic coefficients from an ordered logistic regression into marginal effect coefficients. The primary result of using two independent binary logistic models is a loss of efficiency, rather than biased estimators (W. Bowman (of USNA Economics Department), personal communication, May, 2005).

*a. Midshipmen Graduation Rate and Leadership First Class Year*

The dependent variables of midshipmen graduation rates and leadership use the same model for analysis. A binary logistic model is used to classify which midshipmen are likely to graduate and which midshipmen are likely to have four or more stripes (out of six) during the first class year.

**Table 20. Logistic Regression Models for Graduation and Stripers**

<b>Variables</b>	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>
<b>Dependent Variables</b>			
Graduation or Stripers	X	X	X
<b>Independent Variables</b>			
Class Year	X	X	X
Gender	X	X	X
Demographic Group	X	X	X
Prior Enlisted		X	X
Legacy		X	X
Accession Source		X	X
Athletic Recruit		X	X
SAT Math and Verbal		X	X
High School Rank		X	X
Athletic ECA Score		X	X
Non-Athletic ECA Score		X	X
Career Interest Score		X	X
Technical Interest Score		X	X
Teacher Recommendations			X
RAB Categories			X
Personality			X
Cases available for Graduation	7127	5987	5987
Cases available for Stripers	4817	4817	4817

Unfortunately not all the midshipmen in the data set have values for the variables to be used in the models. For the graduation models, the second and third models are affected in that they have only 5,987 cases of midshipmen with values in all the independent variables available for analysis. The striper models have 4,817 cases of midshipmen available for analysis; not all the cases of midshipmen persisting to first class year have all the requisite variables needed for analysis resulting in a loss of about

15%. This phenomenon highlights the fact that reduction in sample size reduction exist; but, should not impact the model's coefficients and overall findings.

***b. Midshipmen Military Performance Grades***

Military performance grades (now called Aptitude for Commission grades) are analyzed in two batteries of binary logistic models. Each battery has three regressions that are defined in the same manner as those for the graduation and striper models. The first battery of models attempts to predict which midshipmen are likely to receive an A in military performance, and the second battery seeks to predict which midshipmen are likely to receive a C in military performance. Midshipmen with a B in military performance are not modeled explicitly, and may be considered the main reference group for both binary logistic models. Given that this dependent variable has three possible outcomes (A, B, or C), this study seeks to find information about over or under performing midshipmen (those with an A or C in military performance) relative to average performing midshipmen (those with a B in military performance). The table below shows the variables and how they are used to explore military performance grades.

**Table 21. Multinomial Logistic Regression Models for Military Performance Grades**

<b>Variables</b>	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>
<b>Dependent Variables</b>			
A or C in Military Performance Grade	X	X	X
<b>Independent Variables</b>			
Class Year	X	X	X
Gender	X	X	X
Demographic Group	X	X	X
Prior Enlisted		X	X
Legacy		X	X
Accession Source		X	X
Athletic Recruit		X	X
SAT Math and Verbal		X	X
High School Rank		X	X
Athletic ECA Score		X	X
Non-Athletic ECA Score		X	X
Career Interest Score		X	X
Technical Interest Score		X	X
Teacher Recommendations			X

RAB Categories			X
Personality			X
Cases available for regression analysis	4791	4791	4791

Much like the previous series of models, the number of midshipmen with military performance grades over all four years is much lower than the total number of cases of midshipmen in the data set. Both batteries of models have just 4791 cases for analysis. Again the smaller number highlights a reduction in sample size.

*c. Cumulative Academic Quality Point Rating*

For cumulative academic QPR, the independent variables are arranged for the three ordinary least squares models in the same manner as that found for the logistic models. Table 22 below shows how the independent variables are incorporated into the three models.

**Table 22. Ordinary Least Squares Regression Models for CAQPR**

<b>Variables</b>	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>
<b>Dependent Variables</b>			
Cumulative Academic QPR	X	X	X
<b>Independent Variables</b>			
Class Year	X	X	X
Gender	X	X	X
Demographic Group	X	X	X
Prior Enlisted		X	X
Legacy		X	X
Accession Source		X	X
Athletic Recruit		X	X
SAT Math and Verbal		X	X
High School Rank		X	X
Athletic ECA Score		X	X
Non-Athletic ECA Score		X	X
Career Interest Score		X	X
Technical Interest Score		X	X
Teacher Recommendations			X
RAB Categories			X
Personality			X
Cases available for regression analysis	5485	5485	5485

The three models run for the variable cumulative academic QPR have 5485 cases available for analysis. The full data set cannot be used because not all midshipmen have information for the requisite variables.

#### **E. CHAPTER SUMMARY**

This chapter has accomplished the following: described the data source, defined the dependent and independent variables, and detailed the number and types of regression models to be run. It also highlighted the fact that not all the cases can be used in the models due to limitations in the data set mainly because many cases of midshipmen are missing data. The next chapter presents results for individual bivariate analysis of independent variables to dependent variables to take place. This is a necessary prerequisite for interpreting the results of the regression models.



## **IV. PRELIMINARY DATA AND ANALYSIS**

### **A. INTRODUCTION**

This portion of the study focuses on individual bivariate analysis of the independent variables with the four dependent variables. It begins with a table of hypothesized effects between the independent variables and the four measures of success: graduation, stripers, military performance scores, and cumulative academic quality point rating. The following three sections in this chapter will concentrate on interactions that the independent variables have with dependent variables; independent variables are grouped in the same manner as they were presented in the previous chapter (control variables, quantitative variables, and qualitative variables). Lastly, some of the data analysis will also be between two independent variables to make known certain trends in the data.

### **B. HYPOTHESIZED EFFECTS**

Hypothesized effects derived from the findings made known in the literature review showing what impact independent variables could have on the measures of midshipmen success (dependent variables) are presented in Table 23. This provides a frame of reference by which to interpret statistical regression model results. Table 23 is structured by dependent variables and by the three models to be run for each dependent variable. A plus sign signifies that a positive relationship is expected between the independent and dependent variable. A negative sign signifies a negative relationship. The '↔' symbol is meant to signify the relationship between the independent and dependent variable is unknown and an expected or positive or negative relationship cannot be predicted. The expected relationships between the independent and dependent variables illustrated in this table will be explained in more detail in the following sections.

**Table 23. Hypothesized Effect of Independent Variables on Midshipmen Success**

Independent Variables		Dependent Variables		
	Graduation	Leadership	Military Performance Grades*	Cumulative Academic QPR
<b>1st Model</b>				
Class Year **	↔	↔	↔	↔
Gender (Female)	-	+	↔	↔
Demographic Group:				
Caucasian (reference)				
African American	↔	+	↔	↔
Hispanic	↔	+	↔	↔
Asian American	↔	+	↔	↔
Other	↔	+	↔	↔
<b>2nd Model</b>				
SAT Math	+	+	+	+
SAT Verbal	+	+	+	+
High School Rank	+	+	+	+
CIS	+	+	+	+
TIS	+	+	+	-
Athletic ECA	+	+	+	+
Non-Athletic ECA	+	+	+	+
Prior Enlisted	+	+	↔	↔
Legacy	+	↔	↔	↔
Accession Source:				
Direct (reference)				
NAPS	+	↔	↔	↔
Foundation	↔	↔	↔	↔
Nuke	↔	↔	↔	↔
BOOST	↔	↔	↔	↔
Athletic Recruit Status:				
Non Recruits (reference)				
Male Recruit	↔	↔	↔	↔
Male Blue Chip Recruit	↔	↔	↔	↔

	Graduation	Leadership	Military Performance Grades*	Cumulative Academic QPR
Female Recruit	↔	↔	↔	↔
Female Blue Chip Recruit	↔	↔	↔	↔
<b>3<sup>rd</sup> Model</b>				
Teacher Recommendations	+	+	+	+
RAB Impact **	↔	↔	↔	↔
Temperament/Personality:				
Guardian (reference)				
Rational	↔	↔	↔	↔
Idealist	↔	↔	↔	↔
Artisan	↔	↔	↔	↔

\* The hypothesized effect for military performance grades is such that a '+' equates to a higher grade and a '-' equates to a lower grade. Individual predictions for A, B, or C grades should not to be inferred.

\*\* Subsequent class years and RAB categories are predicted to have the specified effect over previous ones.

The positive effect for females and all minorities in leadership is derived from the findings in Fox's (2003) study into strippers. Minorities and women were favored to be four strippers or above ( $p < .01$ ). Regarding cumulative academic QPR, some minorities have been found to have higher academic performance. Recalling FitzPatrick's (2001) study, he found that African Americans and Hispanics (excluding Puerto Ricans) from NAPS and Foundation prep schools had significantly ( $p < .05$ ) higher academic QPR than midshipmen of like demographic groups from other accession sources. However, predicting the overall effect (regardless of accession source) these demographic groups have on academic performance is unknown. As for the other measures of success, previous studies have not made any definitive trends by demographic group and only some relative to gender. The predicted effect that demographic groups have on graduation and military performance grades is unknown. For women and graduation the

predicted effect is negative. Mitchell's (1999) study of female midshipmen at the Naval Academy found that if they had lower academic performance, they were more likely to leave the Naval Academy.

### **C. CONTROL VARIABLES**

Before discussing specific information within the following tables, one should understand how the tables are set up. For categorical independent variables, each possible category has its own row. Next, from left to right, the columns begin with the overall frequency a particular category has in the data set followed by specific mean scores for graduation, four strippers and above, military performance grades (A, B, and C), and mean cumulative AQPR information for each category in the independent variable. The information presented in the columns for continuous variables begins with the mean score in the data set, followed by average scores for graduates, non graduates, four strippers and above, three strippers and below, and all three military performance scores. For cumulative academic QPR and continuous independent variables, the independent variable is grouped into four or more equal groups, the mean scores for cumulative academic QPR are calculated for each group, and then presented in a line graph (independent variable vs. mean cumulative academic QPR). Essentially, a continuous variable is made into a categorical one for the purposes of making it easier to illustrate what, if any relationship exists between it and mean cumulative academic QPR.

#### **1. Demographic Group**

Table 24 compares midshipmen by demographic group affiliation and the success factors of interest to this study. It is particularly rich in information and gives one an idea of how certain demographic groups fare relative to others. The first column shows the distribution of the demographic groups found within the data set. The graduation column shows the rate of graduation for members a particular demographic group with the overall graduation rate is found at the bottom. The next column's information is structured such that it gives the percentage of the midshipmen leadership ranks of four stripes and above from each of the ethnic groups. For example, 2.2% of those midshipmen having four or more stripes are Hispanic. The next three columns show how the three military performance grades of interest to this study are distributed by demographic group; adding the percentages across will equal 100.0% and the last row

(Average/Total) gives the overall distribution of the grades in the data set. The last column, mean cumulative academic QPR, shows mean academic performance by demographic group with the overall average at the bottom of the table. This format will be used extensively over the rest of this chapter.

**Table 24. Demographic Group vs. Dependent Variables**

	Brigade Composition	Graduation Rate	Four Stripers and Above	Military Performance Grade A	B	C	Mean Cumulative AQPR
Caucasian	81.0%	80.8%	85.9%	30.2%	56.2%	13.6%	2.86
African American	6.2%	71.7%	7.8%	14.2%	52.8%	33.0%	2.37
Hispanic	7.5%	74.5%	2.2%	20.7%	57.9%	21.4%	2.59
Asian American	4.2%	79.1%	3.7%	27.0%	57.9%	15.0%	2.86
Other	1.1%	66.7%	0.4%	13.5%	46.2%	40.4%	2.69
Average / Total	100.0	79.5%	100.0%	28.3%	56.1%	15.5%	2.81

Source: Institutional Planning, Research, and Assessment, 2004.

The first main trend to be made from this table is that Caucasian and Asian American Midshipmen appear to do better than the other demographic groups, and there appears to be little that distinguishes the two from each other in any of the four measures of midshipmen success. Another discernable observation from the data is that African American midshipmen have the second lowest graduation rate (71.7%), the lowest cumulative AQPR (2.37), and are distributed at higher rates within the lowest of the three performance grades. However, African Americans have the highest minority representation for four stripers and above; they are overly represented at 7.8% given that they constitute 6.2% of the total Brigade. On the other hand, Hispanics make up only 2.2% of the higher ranking leaders of the Brigade in the data set while they represent 7.5% of the total. The next table shows, by demographic group, the numbers of midshipmen in senior leadership positions from 1999 to 2004.

**Table 25. Demographic Group vs. Senior Leadership Positions**

	First Class Midshipmen Rank					
	Midshipman Lieutenant Commander.		Midshipman Commander		Midshipman Captain	
	4 Stripes		5 Stripes		6 Stripes	
	n	%	n	%	n	%
Caucasian	169	88.0	53	80.3	10	83.3
African American	12	6.3	8	12.1	1	8.3
Hispanic	4	2.1	2	3.0	0	0.0
Asian American	7	3.6	2	3.0	1	8.3
Other	0	0.0	1	1.5	0	0.0
Total	192	100.0	66	99.9	12	99.9

Source: Institutional Planning, Research, and Assessment, 2004.

In the four striper category, African Americans outnumber Hispanics three to one, and there are almost double the numbers of Asian Americans compared to Hispanics. For midshipmen with five stripes, African Americans outnumber Hispanics four to one. These rates do not mirror the distribution of each demographic group in the overall Brigade (see column 1 of Table 24 for comparison). In the Midshipman Captain rank, only Hispanic or Other midshipmen have never held this rank. Lastly, Caucasian midshipmen will serve as the reference category in the regression models allowing coefficients to be generated for all minority demographic groups in the following chapter.

## 2. Gender

Women have been attending the Naval Academy for almost thirty years, and average 15% to 18% of the Brigade each year (IR, 2004). But, their observed performance has consistently lagged that of males. Table 26 below details the differences between the sexes.

**Table 26. Gender vs. Dependent variables**

	Brigade Composition	Graduation Rate	Four Stripers and Above	Military Performance Grade			Mean Cumulative AQPR
				A	B	C	
Male	83.3%	81.0%	78.1%	28.5%	55.5%	16.0%	2.82
Female	16.7%	72.0%	21.9%	27.4%	59.4%	13.2%	2.77
Average / Total	100.0	79.5%	4.8%	28.3%	56.1%	15.5%	2.81

Source: Institutional Planning, Research, and Assessment, 2004.

Women graduate at a lower rate (almost 10 percentage points) and have a lower cumulative AQPR (.05 points) than do males. The common explanation for the lower performance is that, women are at a disadvantage because the primary (military) culture more closely identifies with the male culture than the female one. Regardless of the lower performance, females occupy more of the higher leadership positions in the Brigade. Approximately 22% of the four stripers and above are women; yet they make up about 17% of the data set. With regard to military performance grades, women are concentrated at a slightly higher rate in the B category versus the A and C groups than are males. Male midshipmen will serve as the reference group for regression analysis in the next chapter.

### 3. Graduation Year

Graduation year is included in this study to control for changes in mean scores of the dependent variables; changes that could otherwise be correlated with time variant independent variables. The table below shows the mean values of the dependent variables by class year.

**Table 27. Class Year vs. Dependent variables**

	Graduation Rate	Four Stripers and Above	Military Performance Grade			Mean Cumulative AQPR
			A	B	C	
1999	77.0%	5.1%	33.3%	55.5%	11.3%	2.74
2000	79.0%	4.7%	30.1%	57.2%	12.7%	2.78
2001	78.9%	4.8%	27.2%	57.9%	14.9%	2.82
2002	79.9%	4.8%	26.4%	57.1%	16.4%	2.81
2003	80.5%	4.5%	27.4%	53.7%	18.9%	2.84
2004	81.6%	4.6%	26.0%	55.5%	18.5%	2.86

Source: Institutional Planning, Research, and Assessment, 2004.

From 1999 to 2004 there is a slight upward trend in the graduation rate and in the cumulative AQPR (an increase of .12 points). At the same time however, the numbers of midshipmen receiving an A for performance grades has decreased by 7.3 percentage points, and the number of midshipmen earning a C in performance is rising by almost the same rate (7.2 percentage points). The 1999 class year will be the reference group for all regression calculations.

#### **D. QUANTITATIVE VARIABLES**

##### **1. Components of the Candidate Multiple**

###### **a. SAT Scores**

While not directly related to all the measures of midshipmen success, SAT scores remain an important piece of information for this study. The following table shows the mean SAT scores for three of the four measures of success.

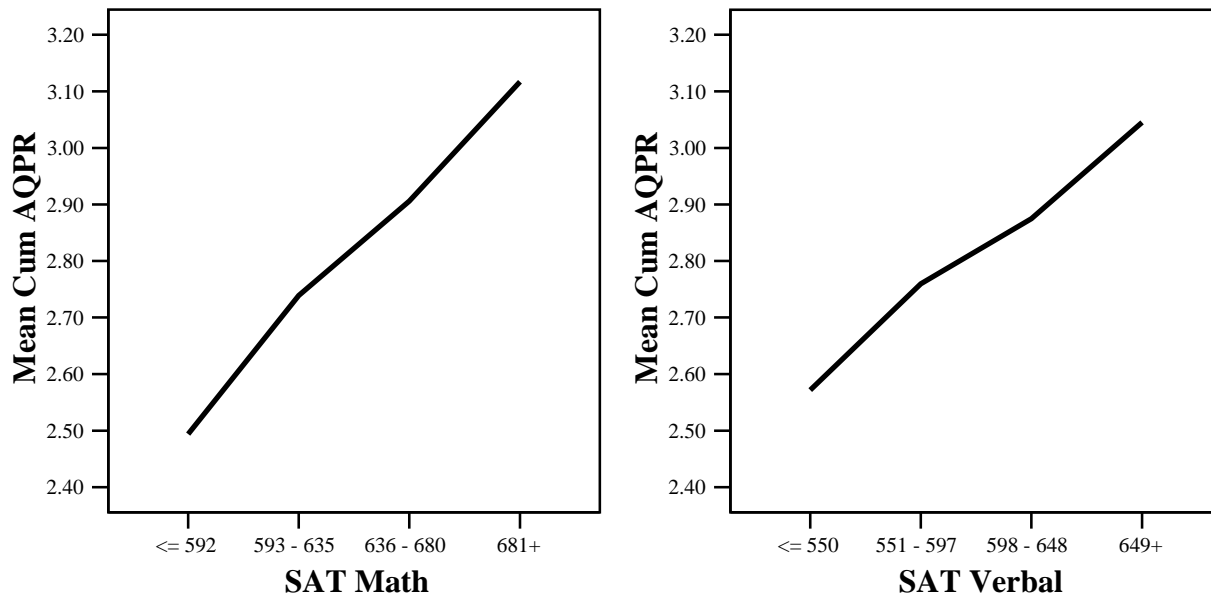
**Table 28. Mean SAT Scores vs. Graduation, Stripers, and Military Performance Grades**

	Graduation			Stripers		Military Performance Grade		
	Average Score	Graduate	Attrite	4 Striper or Above	3 Striper or Below	A	B	C
Math	662	637	628	656	636	650	635	618
Verbal	635	597	595	619	596	610	595	579

Source: Institutional Planning, Research, and Assessment, 2004.

It is clear from this table that higher math and verbal SAT scores are associated with graduation, higher military performance grades, and more senior leadership positions within the Brigade. But, the difference in SAT verbal scores between those that graduated and those that attrited is negligible. The graphs below show the relationship between math and verbal SAT scores (split into quartiles) and cumulative AQPR; showing a similar trend.





**Figure 7. SAT Scores vs. Mean Cumulative Academic QPR**

A midshipman with higher math or verbal SAT scores tends to have higher average cumulative academic QPR. In general, observed higher SAT scores are found in higher performing midshipmen more often than not.

**b. High School Rank**

The information for high school rank presented below is similar to SAT scores in that it does not directly relate to success for midshipmen. But, there are some differences in mean high school rank within the categories of the dependent variables.

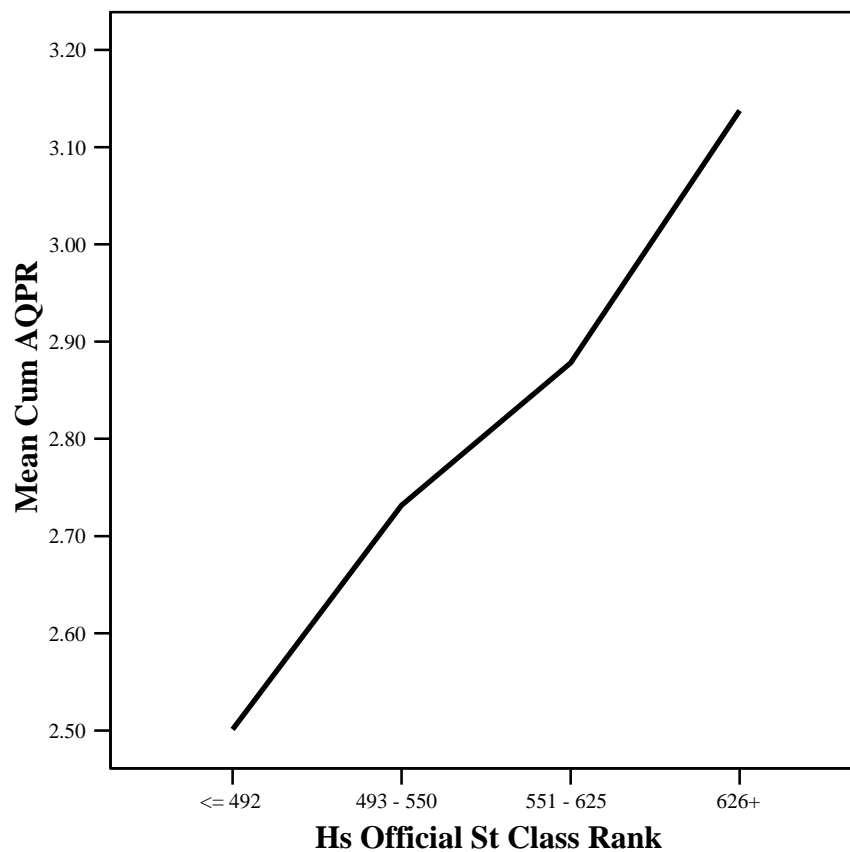
**Table 29. Mean High School Rank vs. Graduation, Strippers, and Military Performance Grades**

Average Score	Graduation		Strippers		Military Performance Grade		
	Graduate	Attrite	4 Striper or Above	3 Striper or Below	A	B	C
564	568	551	606	566	605	561	523

Source: Institutional Planning, Research, and Assessment, 2004.

Similar to the pattern of SAT scores, a higher score in high school rank is found in those that graduate, assume senior leadership positions, and earn higher military performance scores. The graph below illustrates the relationship between high school

rank and cumulative academic QPR. High school rank has been split into quartiles to facilitate presentation of the relationship between the two variables.



**Figure 8. High School Rank vs. Mean Cumulative Academic QPR**

The graph shows that one's high school ranking is positively associated with academic performance; the extent to which it is so cannot be determined by the information presented here. But, this study will hypothesize that higher standardized high school rank is correlated with midshipmen success.

***c. Career Interest Score and Technical Interest Score***

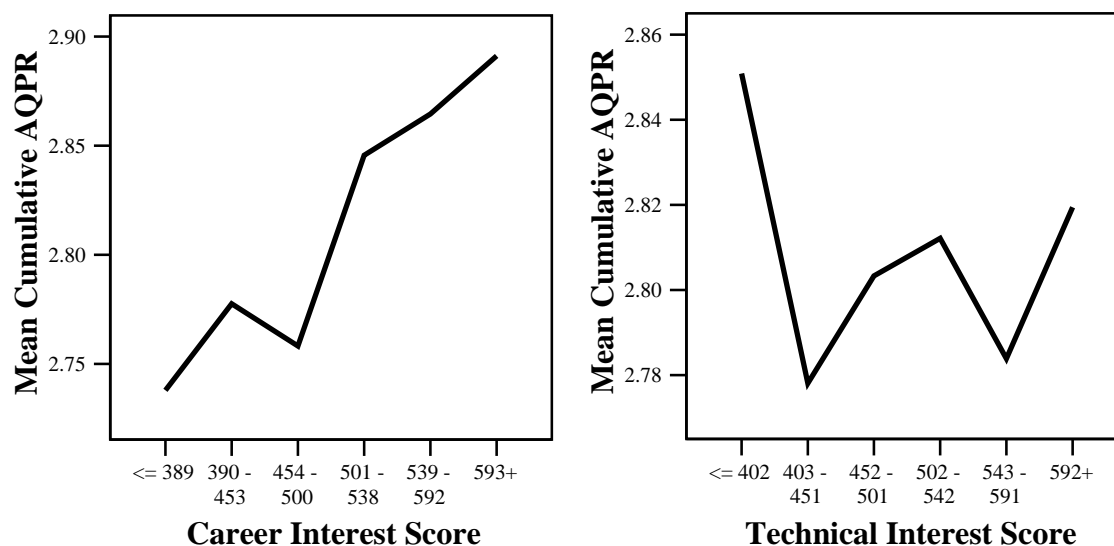
The CIS and TIS are grouped together given that both scores are derived from the Strong Campbell Interest Inventory. Table 30 details how these variables, designed to measure a midshipman's propensity to make the Navy a career (CIS) or select a technical major (TIS), are related to graduation, senior leadership positions of the Brigade, and military performance grades.

**Table 30. Mean CIS and TIS scores vs. Graduation, Strippers, and Military Performance Grades**

		Graduation			Strippers		Military Performance Grade		
		Average Score	Graduate	Attrite	4 Striper or Above	3 Striper or Below	A	B	C
Mean Scores	CIS	492	495	480	503	495	505	494	484
	TIS	494	495	492	465	497	491	496	500

Source: Institutional Planning, Research, and Assessment, 2004.

This table presents some interesting information in that a lower mean TIS score is associated with higher military performance grades and with a higher level of leadership (stripers). The other trend observed is that higher CIS and TIS scores are associated with better performance in the other measures of success. The graphs presented below shows the relationship the CIS and TIS have with cumulative academic QPR. Both scores have been grouped into six equal groups for ease of finding trends.



**Figure 9. CIS & TISAT Scores vs. Mean Cumulative Academic QPR**

The graph for the CIS score shows a generally positive relationship between the CIS and cumulative academic QPR. On the other hand, the TIS graph is not as straight forward. Given the illustrated pattern of relationships between the TIS and academic performance,

it may prove difficult to hypothesize what affect the TIS will ultimately have in the statistical regressions of the next chapter.

***d. Athletic and Non-Athletic ECA Score***

Athletic and Non-Athletic ECA score are very similar to each in that each attempts to quantify what, if any level of extra-curricular involvement a midshipman had during his or her high school years. The following table shows how each measure relates to midshipman success.

**Table 31. Mean Athletic and Non-Athletic ECA scores vs. Graduation, Strippers, and Military Performance Grades**

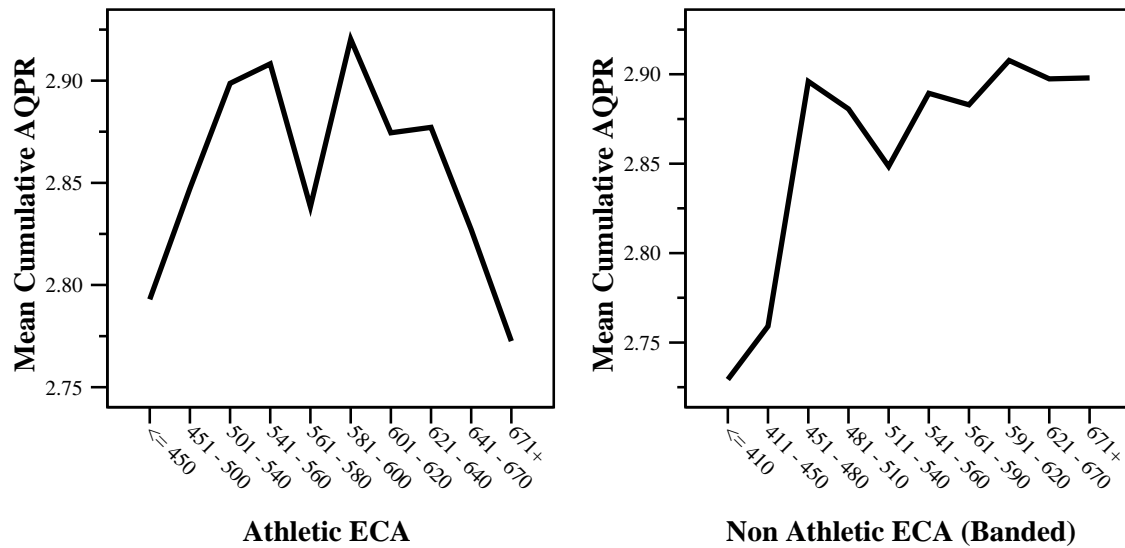
		Average Score	Graduation		Strippers		Military Performance Grade		
Mean Scores			Graduate	Attrite	4 Striper or Above	3 Striper or Below	A	B	C
	AECA	570	572	563	586	571	577	569	574
	NAECA	539	541	531	576	539	557	540	512

Source: Institutional Planning, Research, and Assessment, 2004.

The general assessment to be made from this table is that higher AECA and NAECA scores appear to be positively related to graduation, strippers, and military performance. This matches the finding from Michael's 1999 thesis on military background and midshipman performance at the Naval Academy and Fleet in which a higher AECA score was positively correlated to graduation<sup>5</sup>. The same was not found for the NAECA score however. The figure below shows the relationships between the ECA score and cumulative academic QPR. Both the AECA and NAECA scores have been banded into ten equal groups for ease of presentation and illustrating the relationship.

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<sup>5</sup> Michael's study ran a binary logistic regression to predict graduation and used some, but not all the variables this study intends to use in predicting midshipmen graduation.



**Figure 10. AECA & NAECA Scores vs. Mean Cumulative Academic QPR**

If not for the dip in the middle of the graph between the AECA scores and cumulative academic QPR, it would appear to follow a roughly normal distribution. But, one can generally conclude that midshipmen with AECA scores in the middle or close to the mean appear to do better academically. As for the NAECA score, it seems to exhibit a positive relationship with cumulative academic QPR.

## **2. Prior Enlisted and Legacy Midshipmen**

Prior enlisted and legacy midshipmen are grouped together because both reflect in a midshipmen an affinity for, or familiarization of military life. The following table shows the mean scores of midshipmen in these categories (versus those that are not) against the measures of success.

**Table 32. Prior Enlisted and Legacy Midshipmen vs. Dependent Variables**

	Brigade Composition	Graduation Rate	Four Stripers and Above	Group Military Performance Grade			Mean Cumulative AQPR
				A	B	C	
Prior Enlisted	7.4%	79.1%	6.7%	29.9%	58.1%	12.0%	2.71
Non Prior Enlisted	92.6%	79.5%	93.3%	28.2%	56.0%	15.8%	2.82
Legacy	41.3%	79.9%	41.9%	28.3%	56.3%	15.5%	2.81
Non Legacy	58.7%	79.2%	58.1%	28.4%	56.0%	15.6%	2.81
Average / Total	100.0	79.5%	100.0	28.3%	56.1%	15.5%	2.81

Source: Institutional Planning, Research, and Assessment, 2004.

The majority of the information presented above is homogenous in that, there is little differentiation in values of midshipmen success. The number of prior enlisted midshipmen with more than four stripes, at 6.7%, is slightly less than the 7.4% of the dataset that are prior enlisted. The distributions of four stripers and above amongst legacy (41.9%) and non-legacy (58.1%) midshipmen are both within one percent of the overall distributions for these types of midshipmen, 41.2% and 58.8% respectively. Military performance grades are almost the same in all categories; except for prior enlisted midshipmen in the B and C groups. These midshipmen appear to populate the C category at a lower rate and the B category at higher rate than midshipmen with no prior enlisted experience. But, the largest difference found is in academic QPR; prior enlisted midshipmen have a lower mean score (by .11 points) relative to midshipmen with no prior enlisted experience. Midshipmen with no prior enlisted experience and without legacy are to be the reference group for the regression models.

### 3. Accession Source

There are five different accession sources midshipmen come from before matriculating. They are Direct Entry, the Naval Academy Preparatory School (NAPS),

the Naval Academy Foundation (Foundation), the Navy’s nuclear training pipeline (Nuke), and the Broadened Opportunity for Officer Selection and Training (BOOST) program. The table below shows the observed differences in performance of midshipmen from different accession sources.

**Table 33. Accession Source vs. Dependent Variables**

	Brigade Composition	Graduation Rate	Four Stripers and Above	Military Performance Grade A	B	C	Mean Cumulative AQPR
Direct	77.3%	79.3%	83.0%	30.7%	55.4%	14.0%	2.88
NAPS	15.0%	78.3%	11.5%	17.1%	57.8%	25.1%	2.48
Foundation	6.1%	83.4%	4.4%	29.1%	58.2%	12.7%	2.70
Nuke	1.3%	83.7%	1.1%	18.2%	67.5%	14.3%	2.93
BOOST	0.3%	90.9%	0.0%	15.0%	70.0%	15.0%	2.73
Average / Total	100.0	79.5%	100.0	28.3%	56.1%	15.5%	2.81

Source: Institutional Planning, Research, and Assessment, 2004.

This table has much information worthy of discussion, and analysis will be partitioned by measures of success. First, the graduation rates of all but the BOOST midshipmen are between 78% and 84%. BOOST midshipmen have the highest graduation rate at about 91%, but make up the smallest of the five groups (22 midshipmen total). Secondly, the four strippers are slightly overrepresented with Direct Entry midshipmen (83.0%) relative the general Brigade composition of (77.3%). This overrepresentation is made at the expense of the other four accession sources. Collectively, they make up a smaller portion of the four strippers than they do the general Brigade population.

With regard to military performance grades, Direct Entry and Foundation midshipmen have about twice the level of representation in the ‘A’ military performance grade compared to the other groups (30% vs. approximately 16%). For the ‘B’ military performance grade, direct, NAPS, and Foundation midshipmen have about the same

amount of representation (55% and 58% respectively); but, Nuke and BOOST midshipmen have even higher representation (68% and 70% respectively). The only notable difference to be seen in the ‘C’ grade group is that proportionally, midshipmen from NAPS (NAPSters) have almost double the number in this grade than the other four groups (25% vs. approximately 12% to 15%). The last measure of success highlights the NAPSters again in that they have a much lower cumulative academic QPR (2.48) relative to the other four accessions sources; whose averages are all higher than 2.70 and within .23 points of each other. Given that the majority of midshipmen matriculating are Direct Entry, this group will be excluded from the regression models and serve as the reference group.

#### 4. Athletic Recruit Status

The following table details the differences in performance of athletes and non-athletes by type of recruiting (none, regular, or blue-chip recruit) and by gender.

**Table 34. Athletic Recruit Type vs. Dependent Variables**

		Brigade Composition	Graduation Rate	Four Stripers and Above	Military Performance Grade			Mean Cumulative AQPR
					A	B	C	
Male	Non Recruit	59.9%	81.5%	61.5%	32.0%	55.4%	12.6%	2.87
	Recruit	9.2%	84.9%	11.1%	30.0%	54.7%	15.3%	2.89
	Blue Chip Recruit	14.2%	77.1%	5.6%	11.8%	56.9%	31.3%	2.52
Female	Non Recruit	9.9%	67.3%	14.8%	26.1%	61.6%	12.4%	2.74
	Recruit	3.4%	83.7%	6.3%	36.6%	49.8%	13.7%	2.97
	Blue Chip Recruit	3.3%	74.3%	0.7%	20.5%	64.8%	14.8%	2.65
	Average / Total	100.0	79.5%	100.0	28.3%	56.1%	15.5%	2.81

Source: Institutional Planning, Research, and Assessment, 2004.

This table presents a number of trends. First, regardless of gender, recruited athletes have the highest graduation rates and are over represented in senior leadership



positions relative to the overall Brigade composition. Secondly, the non-recruits (male and female) make up more of the four stripers or above relative to their overall Brigade representation. The next observation to be made, is that regardless of gender, blue-chip recruited athletes are not receiving proportionally as many ‘A’s in military performance grades as the other groups; both scores are well below the average of 28.3%. Blue chip recruit athletes also have the lowest cumulative academic QPR of the six groups; and male blue-chip recruited athletes populate the ‘C’ category for military performance grades at double the rate compared to the other male groups. Lastly, the highest average cumulative academic QPR scores are found for the recruited athletes. It is important to remember this study does not account for any level of sports participation or extra-curricular activity involvement these groups have after entering the Naval Academy. The reference groups for subsequent regression analysis will be non-recruited male and females. This follows the previous trend already established of making the largest categories the reference groups.

## E. QUALITATIVE VARIABLES

### 1. High School Teacher Recommendations

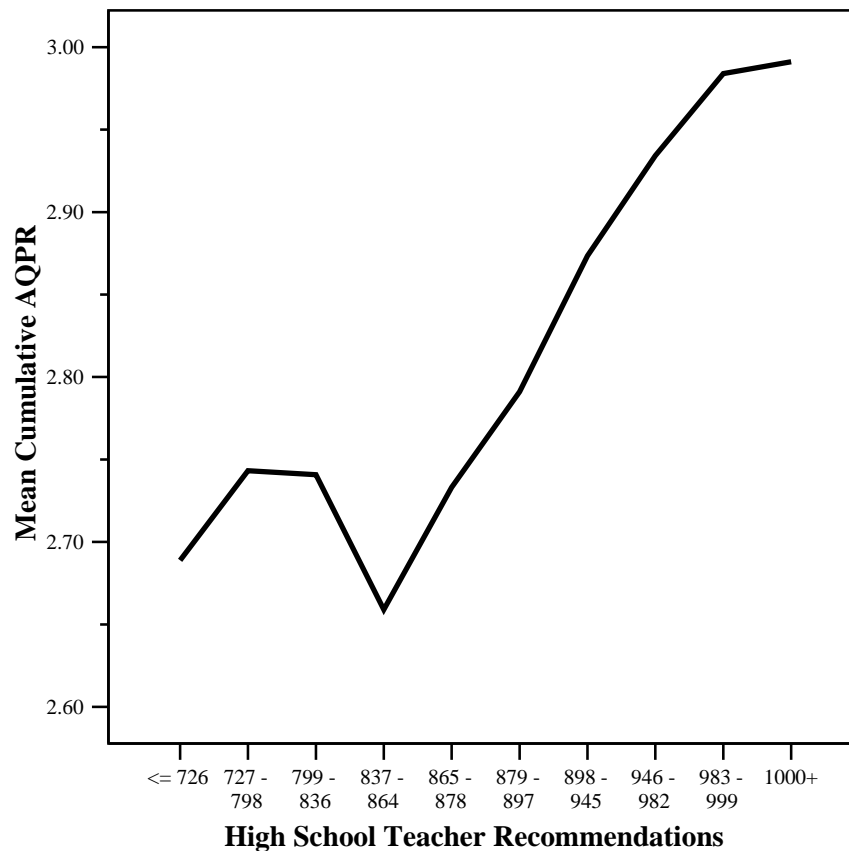
The following table shows the relationship of the high school teacher recommendations portion of the cumulative multiple score with graduation, Brigade leadership, and military performance scores. By and large, the relationship with the measures of success follows that established by SAT, CIS, TIS, athletic, and non-athletic ECA scores. A higher teacher recommendation score is found in those midshipmen with higher performance.

**Table 35. Mean High School Teacher Recommendations vs. Graduation, Stripers, and Military Performance Grades**

Average Score	Graduation		Stripers		Military Performance Grade		
	Graduate	Attrite	4 Striper or Above	3 Striper or Below	A	B	C
878	881	868	921	879	909	876	847

Source: Institutional Planning, Research, and Assessment, 2004.

In the figure below one can see the relationship between the teacher recommendations score and cumulative academic QPR. Teacher recommendations scores have been banded into ten equal groups. This simplifies the graph, and makes it easier for one to observe the relationship with academic performance.



**Figure 11. Teacher Recommendation Scores vs. Mean Cumulative Academic QPR**

The graph shows a positive relationship between teacher recommendations and academic QPR only after recommendation scores are above 864. Before this score there is a hump. Those in the three lowest teacher recommendation category are doing better than those in the fourth. This complex interaction may prove difficult to condense into one coefficient in the regression models.

## **2. Impact of Recommendations of the Admissions Board (RAB)**

To review, a RAB score is a qualitative assessment by admissions board members that attempts to find yet unmeasured positive or negative information in a candidate's application package. RAB scores are added to the cumulative multiple to create the

whole person multiple. They are given to candidates throughout the range of cumulative multiple scores; but, to varying degrees. For the most part, candidates with lower cumulative multiples are given higher RAB scores.

The cases of midshipmen in this dataset have been split into eight groups called RAB categories. The first group has slightly more midshipmen in it than the other seven. Doing so encapsulates all the midshipmen in the cumulative multiple range that would not be considered for review by the Admissions Board without the addition of RAB scores. Higher RAB categories have successively higher cumulative multiple scores. Further information on RAB scores may be found in Chapter III. Table 36 below details how midshipmen in these RAB categories fare in the measures of success.

**Table 36. RAB Categories vs. Dependent Variables**

RAB Category	Graduation Rate	Four Stripers and Above	Military Performance			Mean Cumulative AQPR
			A	Grade B	C	
1	74.3%	5.6%	13.8%	57.5%	28.7%	2.39
2	75.5%	8.1%	18.2%	58.0%	23.8%	2.51
3	76.9%	7.4%	23.2%	56.9%	20.0%	2.66
4	79.6%	12.2%	24.3%	60.3%	15.4%	2.77
5	81.6%	12.2%	28.7%	58.3%	13.1%	2.84
6	81.3%	14.1%	30.2%	58.4%	11.3%	2.96
7	83.2%	11.9%	36.2%	55.6%	8.2%	3.08
8	83.8%	28.5%	48.9%	44.8%	6.3%	3.26
Average / Total	79.5%	100.0	28.3%	56.1%	15.5%	2.81

Source: Institutional Planning, Research, and Assessment, 2004.

In general, there appears to be a positive relationship between cases of midshipmen in higher RAB categories (identified as being more qualified for matriculation by the Admissions Board) and higher graduation rates, senior Brigade leadership, and cumulative academic QPR. Additionally, there is a positive relationship

between higher RAB Categories and an ‘A’ for military performance grades. The inverse is true for the ‘C’ performance grade; the relationship is negative in nature. To summarize, membership in a higher RAB category is positively related to higher performance.

### 3. Keirsey Personality Temperaments

The Keirsey Personality Temperaments variable is the last one to be included in the third battery of regression models for all four measures of midshipmen success. Table 37 shows the personality types, their frequency in the Brigade, and how they fair in midshipman performance.

**Table 37. Personality Type vs. Dependent Variables**

	Brigade Composition	Graduation Rate	Four Stripers and Above	Military Performance Grade A	B	C	Mean Cumulative AQPR
Guardian	41.7%	84.1%	49.4%	33.9%	54.8%	11.3%	2.87
Idealist	14.5%	70.1%	13.2%	22.8%	59.0%	18.2%	2.72
Rational	29.3%	79.9%	28.7%	27.6%	55.2%	17.3%	2.83
Artisan	14.5%	78.6%	8.7%	17.2%	60.2%	22.6%	2.73
Average / Total	100.0	79.5%	100.0	28.3%	56.1%	15.5%	2.81

Source: Institutional Planning, Research, and Assessment, 2004.

The most striking observation to make from this table is that the largest personality type, Guardians (affinity for tradition and heritage, associate strongly with institutional customs and culture), have the highest graduation rate, more four stripers or above, more midshipmen receiving an A in performance, fewer midshipmen in the ‘B’ and ‘C’ military performance categories, and have the highest average cumulative academic QPR than any other group. Coming in second in the same categories, are the Rationals (strategists, planners, and visionaries). Idealists (diplomatic, seeks harmony) have the lowest graduation rate, but almost as many four stripers or above relative to their overall Brigade composition. Artisans (action oriented, autonomous) have a graduation

rate on par with Guardians and Rationals, but have about half the number of midshipmen with an A in performance relative to Guardians and Rationals. These midshipmen are also under-represented in senior leadership positions relative to their representation in the Brigade. Artisans also have double the number of midshipmen with a 'C' in performance compared to Guardians. Being the largest of the four temperaments, Guardians will serve as the reference group.

## **F. CHAPTER SUMMARY**

This chapter accomplished the following:

- Generated a table of hypothesized outcome based on the Independent Variables
- Analyzed the variables (control, qualitative, and quantitative) with regard to the four measures of success or Dependent Variables

With the literature review, variable selection and definition, and a preliminary analysis the independent variables to the dependent variables complete, the model results can be interpreted in the following chapter. These models will empirically evaluate the relationships suggested by the descriptive results presented in this chapter.

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## **V. MODEL RESULTS**

### **A. INTRODUCTION**

This chapter discusses the results from the regression models for the four measures of success. Initially, each measure of success is analyzed alone. Independent variables are partitioned into separate groups and studied over the sequence of the regression models (control variables, quantitative variables, and qualitative variables). Once a review of each model is complete, a determination of any overarching trends or common themes found in some or all four measures of success is presented. Even though this study's focus is on Hispanics, the results of these models are rich in other information that is discussed as well.

Depending on the type of regression model, a marginal effect or un-standardized coefficient is generated. Both are estimates of the change in the probability of a dependent variable due to a unit change in the independent variable, holding other factors constant. If a marginal effect or un-standardized coefficient is statistically significant it means change (either positive or negative) in a particular independent variable will appreciably impact a dependent variable, and this change is unlikely to be because of chance or randomness. However, not all marginal effects or un-standardized coefficients meet the threshold of being statistically significant; that is, the relationship between an independent variable and a dependent variable is either due to chance or weak. Another point to mention before discussing the models is that some of the marginal effects or un-standardized coefficients for the independent variables are multiplied by a factor of one hundred while the values of the dependent variables have been divided by a factor of one hundred. This makes it easier for one to see the relationship some scores have with the dependent variables. For instance, a one point change in the SAT Math score may mean a 0.03% positive change in one's probability in to graduate; but, a more perceptible way to illustrate the relationship would be to say that a one hundred point change in the SAT Math score means a 3.0% positive change in one's probability to graduate.

## **B. GRADUATION**

Table 38 shows the marginal effects of the independent variables for the three binary logistic models that attempt to predict a midshipman's graduation rate. The structure and format for analyzing midshipmen graduation serves as a template for the other three measures of success.



**Table 38. Marginal Effects of Independent Variables on Graduation**

Variables	Marginal Coefficients		
	Model 1	Model 2	Model 3
African American	-0.081 ***	-0.052 **	-0.044 *
Hispanic	-0.057 ***	-0.050 **	-0.029
Asian American	-0.017	-0.026	-0.015
Other	-0.113 ***	-0.113 ***	-0.114 **
Gender	-0.081 ***	-0.109 ***	-0.133 ***
2000	0.016	0.013	0.012
2001	0.018	0.026	0.016
2002	0.023	0.028	0.032 *
2003	0.0337 **	0.0280	0.035 *
2004	0.043 ***	0.0350 *	0.045 **
Prior Enlisted		0.019	0.017
Legacy		0.015	0.016
NAPS		0.072 ***	0.113 ***
Foundation		-0.011	-0.006
Nuke		0.053	0.107 *
BOOST		0.299 *	0.254 **
Male Athletic Recruit		0.052 **	0.044 **
Male Blue Chip Recruit		-0.027	-0.008
Female Athletic Recruit		0.134 ***	0.139 ***
Female Blue Chip Recruit		0.065 **	0.110 ***
SAT Math / 100		0.0348 ***	0.0484 ***
SAT Verbal / 100		-0.0142	-0.0141
High School Rank / 100		0.0247 ***	0.0358 ***
Athletic ECA / 100		0.0159 ***	0.0103 ***
Non-Athletic ECA / 100		0.0078	0.0103 *
Career Interest Score / 100		0.0252 ***	0.0203 ***
Technical Interest Score / 100		-0.0075	-0.0050
Teacher Recommendations / 100			0.0151 ***
RAB Category 1: CM <58k			0.003
RAB Category 2: CM 58 - 60			0.008 **
RAB Category 3: CM 60 - 62			0.016 ***
RAB Category 4: CM 62 - 64			0.021 ***
RAB Category 5: CM 64 - 65.5			0.024 ***
RAB Category 6: CM 65.5 - 67			0.008
RAB Category 7: CM 67- 70			0.008
RAB Category 8: CM 70-79			-0.003
Rational			-0.019
Idealist			-0.111 ***
Artisan			-0.041 **
Model Chi-Square	89.1366	197.027	315.0911
-2 Log Likelihood	7138.49	5777.0065	5859.8751
Pseudo R Squared	0.0195	0.0510	0.0790
Percent Correct Attrite	39.4	55.8	59.3
Percent Correct Graduate	72.6	62.1	62.7
Overall Percent Correct	65.8	60.9	62.0

\*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

## **1. Demographic Group, Gender, and Class Year**

Relative to Caucasians, only African Americans and 'Other' minorities show statistically significant lower graduation rates than for minority groups. Midshipmen in the 'Other' group are 11% less likely to graduate than Caucasians in all three models. But, for African Americans the addition of other independent variables reduces the negative graduation gap for African Americans 8.1% in Model 1, to 4.4% in Model 3. In essence, one-half of the graduation gap for African Americans can be explained by the additional information contained in quantitative and qualitative variables.

The initial negative graduation gap of Hispanics (5.7%) is reduced slightly once quantitative information contained in the candidate multiple is added (-5.0%) in Model 2, and further reduced to -2.9% with the addition of qualitative data in Model 3. Even more important is the fact that the remaining graduation gap of Hispanics due to demographic group alone is no longer statistically significant, and can be attributed to mere chance.

The initial graduation gap for women is relatively large (-8.0%), and is estimated to be even greater (up to a -13.3%), once one controls for additional independent variables contained in Models 2 and 3. The reason for this widening estimate of the graduation gap is due to the over-representation of individual characteristics that are correlated with lower attrition and become specified in Models 2 and 3. For example, female recruited athletes are less likely to attrite and once this factor is included in Model 2, the graduation gap due to being female increases since the dampening effect of being a female athlete is now explicitly accounted for. By contrast, in Model 1, the impact of being a female recruited athlete (not specified in Model 1 analysis) was partially correlated with the female dichotomous variable and as such, reduced the estimate of the coefficient on the gender variable.

As for the class year coefficients, Model 3 complements the observed trend in higher graduation rates with each passing class year. The class year 2002's marginal coefficient for graduation was 3.2% and statistically significant ( $p < .10$ ). For midshipmen from the graduating class of 2003, the marginal coefficient increased to 3.5% and remained significant ( $p < .10$ ). But, by 2004, the marginal coefficient jumped to 4.5% and was statistically significant ( $p < .05$ ). Generally, what this means is that

midshipmen of the later years have a better chance in graduating by virtue of the fact that they matriculated at a later date. This is an observation that should be revisited with the class year coefficients of the cumulative academic QPR model.

## **2. Accession Source, Athletic Recruit, Prior Enlisted, and Legacy**

Midshipmen accession source, athletic recruit, prior enlisted, and legacy status in Models 2 and 3 deserves some mention. First, NAPSters are 11.3% more likely to graduate than those coming to the Naval Academy directly from high school, once the qualitative variables are added in the third model. The same can be said for BOOST midshipmen who are estimated to be 25.4% more likely to graduate than direct appointees. However, the large coefficient may be likely due to the fact that there are relatively few BOOST midshipmen compared to the other accession sources.

Next, focusing on athletic recruits, all but the male blue chip recruited athletes, are predicted to have higher graduation rates (from 4.4% to 13.9%), and all of these marginal coefficients are significant at the 1% or 5% level. Male blue chip recruited athletes are estimated to have similar propensities to graduate compared to non-recruited athletes. It would appear the additional scrutiny these midshipmen have in the admissions processes balances well the need for discovering talented athletes that have the ability to persist for four years and graduate. Lastly, the effect of being prior enlisted or legacy midshipmen does not appear to have any meaningful impact on graduation. As for legacy midshipmen, the way in which this variable is measured may have more to do with the results than anything else. Recalling Michael's (1999) study into legacy midshipmen, he found they were 5% more likely to graduate ( $p < .01$ ); but his definition was more stringent than that used in this study. His research defined a legacy midshipmen as having a parent who was a career military service member (either retired with 20+ years or were on active service during a midshipman's application to the Naval Academy). If this definition was in fact used in this study, the results may have complemented Michael's findings.

## **3. Quantitative Cumulative Multiple Variables**

The majority of components of the cumulative multiple are found to be significant predictors in determining graduation status. Of note, SAT verbal scores are not

significant in Models 2 and 3; but, SAT Math scores are ( $p < .01$ ). In both models, the standardized high school rank variable is also significant ( $p < .01$ ). By Model 3, a 100 point increase in the SAT Math score has positive 4.8% impact on graduation, and a 100 point increase in high school rank has a positive 3.6% increase in graduation probability. What this implies is that the addition of qualitative variables in Model 3 makes the SAT math and high school rank scores more influential predictors for prediction graduation. The Athletic ECA score is significant ( $p < .01$ ) level in both models, but less influential (by 0.6%) once qualitative variables are introduced in the Model 3.

Non-Athletic ECA scores are only significant in the Model 3 ( $p < .10$ ). The estimated impact of a 100 point change in the CIS score is a slightly larger (+ 2.0% versus + 1.0%) than the Athletic ECA score, and significant at the 1% level. This score exhibits the same phenomenon as the Athletic ECA score in that the marginal coefficient of the Model 3 is decreased by about 0.6% compared to the coefficient in the Model 2. It would appear that the qualitative variables affect both of the Athletic ECA and CIS variables in the same way, and that is the influence they have in predicting graduation is minimized. TIS scores are not significant in either the second or third model.

#### **4. Qualitative Variables**

The marginal effects in this group of variables are also rich in data worthy of mention. First, the subjective rating represented in the teacher recommendation scores proves significant in predicting graduation ( $p < .01$ ). A positive one hundred point change in the score increases a midshipman's chance of graduation by 1.5%. The qualitative RAB scores and their interactions with the cumulative multiple captured by the RAB categories also appears to have some impact on midshipmen in the middle to lower middle cumulative multiple range. RAB categories 4 and 5 have a positive 2.1% and 2.4% impact on graduation, both statistically significant ( $p < .01$ ). It would appear that, for midshipmen in these RAB categories, a positive RAB score does more than aid them in the admissions process. Somehow, it captures information about that helps predict graduation as well. However, midshipmen in the lowest or three highest RAB categories shows no benefit in terms of increased likelihood of graduation. Lastly, two of the three personality types prove to negatively impact graduation and are significant. An Idealist midshipman may be particularly at risk in terms of graduating even after

controlling for the other independent variables in the model; they are 11.1% less likely to graduate ( $p < .01$ ). Midshipmen of the Artisan personality are also at risk; but, the relationship is not as strong as that of Idealists ( $p < .05$ ), and the marginal effect is only about a third that of Idealists (-4.1%).

## **5. Model Goodness of Fit Analysis**

From Model 1 to 3, it is interesting to see the correct predictions of those who graduated compared to the correct predictions of those who did not. Initially, the first model did poorly in predicting who attrited (39%) and relatively good in predicting who graduated (73%). Comparing Model 1 to the subsequent models shows that the latter do better in predicting who did not graduate (from 39% to 56% and 59% respectively); but they decrease in the predictive accuracy for those who persisted and graduated (62% and 63% respectively). This may mean that, collectively, the independent variables serve well in predicting who graduates; but, do not do a good job in predicting who leaves. There might be other variables that are better suited in predicting attrition not used in this study. The net effect is that the overall percent correct statistics for Models 2 and 3 are lower than the first model. However, the most important trend to be made in the prediction tables is that, from Model 2 to 3, the addition of qualitative variables increased the predictive accuracy of those that attrited; but, not at the expense of those who graduated (the difference in those that graduated from the Model to 2 to 3 is just 0.6%). Lastly, the pseudo R squared statistic rose from .020 to .051 from Models 1 to 2, and to .079 from Models 2 to 3.

## **C. STRIPERS**

The following table shows the estimated marginal effects of the independent variables in the three binary logistic models used to predict which midshipmen become four stripers or above during the fall or spring semesters first class year (senior) year.

**Table 39. Marginal Effects of Independent Variables on Stripers**

Variables	Marginal Coefficients		
	Model 1	Model 2	Model 3
African American	0.0139	0.0318 ***	0.0310 ***
Hispanic	-0.0527 ***	-0.0296 *	-0.0210
Asian American	-0.0073	-0.0077	-0.0073
Other	-0.0370	-0.0191	-0.0110
Gender	0.0197 ***	-0.0138 **	0.0113 *
2000	-0.0064	-0.0058	-0.0062
2001	-0.0032	-0.0040	-0.0058
2002	-0.0045	-0.0056	-0.0044
2003	-0.0094	-0.0029	-0.0036
2004	-0.0091	-0.0042	-0.0060
Prior Enlisted		-0.0055	-0.0070
Legacy		-0.0026	-0.0021
NAPS		-0.0052	0.0002
Foundation		-0.0115	-0.0058
Nuke		0.0192	0.0232
BOOST		-0.5865	-0.4808
Male Athletic Recruit		0.0065	0.0038
Male Blue Chip Recruit		-0.0157	-0.0093
Female Athletic Recruit		-0.0085	-0.0097
Female Blue Chip Recruit		-0.0556 **	-0.0446 **
SAT Math / 100		0.0059 **	0.0053 **
SAT Verbal / 100		0.0040 *	0.0032 *
High School Rank / 100		0.0038 ***	0.0023 ***
Athletic ECA / 100		0.0041 ***	0.0033 ***
Non-Athletic ECA / 100		0.0033 ***	0.0025 **
Career Interest Score / 100		0.0021 *	0.0013
Technical Interest Score / 100		-0.0051 ***	-0.0034 **
Teacher Recommendations / 100			0.0044
RAB Category 1: CM <58k			0.0005
RAB Category 2: CM 58 - 60			0.0022
RAB Category 3: CM 60 - 62			0.0012
RAB Category 4: CM 62 - 64			0.0032 **
RAB Category 5: CM 64 - 65.5			0.0012
RAB Category 6: CM 65.5 - 67			0.0029 *
RAB Category 7: CM 67- 70			0.0013
RAB Category 8: CM 70-79			0.0030 **
Rational			-0.0054
Idealist			-0.0017
Artisan			-0.0162 **
Model Chi-Square	20.7608	127.9357	163.5648
-2 Log Likelihood	1845.2352	1738.0603	1702.4313
Pseudo R Squared	0.0134	0.0816	0.1040
Percent Correct 3 Striper or Below	72.9	64.7	66.4
Percent Correct 4 Striper or Above	36.1	65.2	67.0
Overall Percent Correct	71.1	64.7	66.4

\*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

## **1. Demographic Group, Gender, and Class Year**

Beginning with results for demographic groups, the most interesting finding is that only African Americans have a positive marginal effect in all three models (+ 3.1% in Model 3); although only the last two are significant ( $p < .01$ ). By the third and most robust model, none of the other demographic groups have marginal effects that are significant. What this means is that, relative to Caucasians (the reference group), only African Americans appear to be more likely (by 3%) to become four stripers or above once one controls for personal characteristics. Other minority midshipmen do not appear to enjoy this advantage. For women, there seems to be a slight advantage (+ 1.1% in Model 3) attaining four or more stripes; but only in Model 1 and 3. Another interesting observation about the marginal effects attributed to women is that, the more robust the model (more independent variables), the less significant the marginal effect is. What this shows is that women are given some positive consideration in becoming the senior leaders of the Brigade, but the relationship is not as strong as that for African Americans. The class year variables are all not significant.

## **2. Accession Source, Athletic Recruit, Prior Enlisted, and Legacy**

The marginal effects for the six categories for the athletic recruit variables have a significantly lower likelihood of attaining higher leadership positions ( $p < .05$ ). This group of midshipmen are about 5% less likely to be the senior leaders of the Brigade (according to the Models 2 and 3). It is probable that the observed differences in the other five categories (as seen in Table 35) are attributed to something else that is not their athletic recruit status.

As for prior enlisted, legacy, or accession source variables, it would appear that none of these variables offers much of an advantage or disadvantage to midshipmen when they seek to become four stripers or above. None of the marginal effects are statistically significant, and except for prior enlisted (whose predicted impact was positive), these findings match the predicted effect these variables would be as shown in Table 23.

### **3. Quantitative Cumulative Multiple Variables**

The most telling finding for the quantitative cumulative multiple variables is that, even with a 100 point change, the marginal effect is less than one percent. So, even though all but the CIS score in Model 3 are statistically significant (most at the 1% and 5% level), these variables don't appear to have much impact on who becomes a four striper or above. This would seem to make sense in that the cumulative multiple (and therefore its components) were not designed to predict who are to be the senior leaders of the Brigade. One should remember that this study looks not at post-entry characteristics or experiences; and these are the variables that probably have more to do with how one becomes a senior leader during his or her first class year.

### **4. Qualitative Variables**

The trend established by the last battery of variables appears to apply as well to the qualitative ones; that is the marginal effects are rather small, and only a quarter of the variables have any statistical significance. Of note, is that the Artisan personality; it is the only variable that has more than a 1% likelihood of impacting (- 1.6%) who becomes a four striper or above ( $p < .05$ ).

### **5. Model Goodness of Fit Analysis**

A brief look at the goodness of fit statistics for all three models shows this value in including qualitative variables in predicting senior Brigade leadership. Even though the individual marginal effects for qualitative variables are small and the differences in Chi-Square and Pseudo R Squared statistics from Model 2 to Model 3 are also small compared to the overall differences from Model 1 to Model 3, they do increase model performance. However, the largest jump in the classification table occurs between Model 1 to 3. The percent correct of those that were predicted to be four stripers and above doubled from 36.1% to 67.0%. This is an especially noteworthy observation given that this model attempts to predict membership for a group that is 4.8% of the dataset (IR, 2004). Another important point to be made is the jump of the Pseudo R squared statistic from .013 in Model 1 to .104 in Model 3. Again, most of the increase in Pseudo R Squared, model Chi-Square, and predictive ability occurred from Model 1 to Model 2, but qualitative variables should not be ignored. They alone (essentially three variables)



added 2% more to the final Pseudo R Squared statistic and percent correct of those that were predicted to be four strippers and above in Model 3. One can not help but wonder if a model that includes the same pre-entry variables coupled with post entry ones would increase model goodness of fit even more. Lastly, regression models may have even better predictive ability if a broadened definition of leadership (three strippers and above) is utilized. This group of cases constitutes 17% of the data set vice 4.8% for four strippers and above; making it easier for a binary logistic regression to make correct predictions (W. Bowman (of USNA Economics Department), personal communication, February, 2005).

#### **D. MILITARY PERFORMANCE GRADES**

This section is split into three groups. The first two will discuss the individual results from the models that attempt to predict an 'A' or 'C' in military performance grades. The last section will determine if there are any overarching trends to be made from the first two sections.

##### **1. An 'A' in Military Performance**

The following table displays the results from the binary logistic model that attempts to predict which midshipmen receive an A in military performance compared to those earning a lower grade. The variables will be split in the same manner above used to evaluate graduation and senior Brigade leadership.

**Table 40. Marginal Effects of Independent Variables on A Military Performance Grades**

Variables	Marginal Coefficients		
	Model 1	Model 2	Model 3
African American	-0.2087 ***	-0.1168 ***	-0.0830 **
Hispanic	-0.0901 ***	-0.0447	-0.0157
Asian American	-0.0373	-0.0586 *	-0.0560 *
Other	-0.2170 **	-0.1792 **	-0.1389 *
Gender	-0.0131	-0.0879 ***	-0.0836 ***
2000	-0.0179	-0.0144	-0.0272
2001	-0.0445 *	-0.0381	-0.0506 **
2002	-0.0784 ***	-0.0756 ***	-0.0657 ***
2003	-0.0688 ***	-0.0437 *	-0.0441 **
2004	-0.0946 ***	-0.0817 ***	-0.0804 ***
Prior Enlisted		0.1717 ***	0.1550 ***
Legacy		-0.0115	-0.0093
NAPS		-0.0144	0.0122
Foundation		0.0078	0.0232
Nuke		-0.1987 ***	-0.1353 **
BOOST		-0.2082	-0.1980
Male Athletic Recruit		-0.0276	-0.0372 *
Male Blue Chip Recruit		-0.1805 ***	-0.1468 ***
Female Athletic Recruit		0.0761 *	0.0459
Female Blue Chip Recruit		-0.0187	-0.0049
SAT Math / 100		0.0147	0.0285 **
SAT Verbal / 100		0.0259 **	0.0297 **
High School Rank / 100		0.0775 ***	0.0689 ***
Athletic ECA / 100		0.0353 ***	0.0349 ***
Non-Athletic ECA / 100		0.0157 **	0.0136 **
Career Interest Score / 100		0.0198 ***	0.0107
Technical Interest Score / 100		-0.0163 **	-0.0061
Teacher Recommendations / 100			0.0495 ***
RAB Category 1: CM <58k			0.0070 *
RAB Category 2: CM 58 - 60			0.0164 ***
RAB Category 3: CM 60 - 62			0.0156 ***
RAB Category 4: CM 62 - 64			0.0106 **
RAB Category 5: CM 64 - 65.5			0.0163 ***
RAB Category 6: CM 65.5 - 67			0.0040
RAB Category 7: CM 67- 70			0.0179 ***
RAB Category 8: CM 70-79			0.0111 *
Rational			-0.0538 ***
Idealist			-0.0797 ***
Artisan			-0.1465 ***
Model Chi-Square	72.384	411.2533	561.5795
-2 Log Likelihood	5723.3803	5384.5113	5234.1851
Pseudo R Squared	0.0214	0.1172	0.1576
Percent Correct No A Grade	50.5	57.3	61.5
Percent Correct A Grade	58.3	67.4	68.4
Overall Percent Correct	52.8	60.2	63.6

\*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

**a. *Demographic Group, Gender, and Class Year***

Starting with demographic group, the results show that for Hispanics, by the time Models 2 and 3 add quantitative and qualitative factors in the admissions process, the negative marginal effects are no longer significant. Hispanic midshipmen do not appear to be favored or biased against in the distribution of the 'A' military performance grades. On the other hand, the other minority groups all appear to have some negative relationship with 'A' grades. Midshipmen in the Other demographic group are affected the most; their marginal effect equates to a negative 14% likelihood of attaining an 'A' grade ( $p < .05$ ). Asian American's marginal coefficient is significant at only the 10% and is associated about a 5.5% less likelihood in receiving an 'A' in performance ( $p < .10$ ). But, the strongest relationship is found in African Americans. Their marginal shows they are about 8% less likely to receive an 'A' grade ( $p < .05$ ). Stronger still, is the relationship for women. By Model 3, they are just over 8% less likely to be given an 'A' in performance. This is slightly lower than the marginal coefficient in Model 2 generated for women, and both coefficients are significant at the 1% level. Generally, Model 3 lowers the negative association for midshipmen minority groups (except for Hispanics) compared to Model 2; but this is not so for women. Their marginal coefficients are relatively constant. The findings for class year reflect the trend in the observed data reported in the previous chapter that more recent years are awarding fewer 'A' military performance grades and more 'C' grades.

**b. *Accession Source, Athletic Recruit, Prior Enlisted, and Legacy***

The marginal coefficients for secondary bio data (e.g. accession source, athletic recruit, prior enlisted, and legacy status) did not significantly impact who become the senior leaders. However, these variables have more influence in predicting which cases of midshipmen receive an 'A' grade. Prior enlisted are heavily favored in receiving the highest performance grade. This may be attributed to the fact that prior enlisted midshipmen may have an advantage in knowing what to expect and how to act (at least initially) in a military environment. What the data does not show is if this advantage is constant over one's four years at the Naval Academy, or if it is shown in the first few

semesters only, when the advantage is likely to be strongest. In contrast, legacy midshipmen have no advantage. This continues the trend seen in the graduation and striper models.

Another striking finding in terms of impact on ‘A’ grades is that of midshipmen from the Nuke accession pipeline. This is the only accession source that has a significant relationship with military performance grades, and it is negative. After incorporating qualitative variables in Model 3, these midshipmen are about 13.5% less likely ( $p < .05$ ) to receive an ‘A’ grade, down from just fewer than 20% ( $p < .10$ ) in Model 2.

Another important finding centers on male blue-chip recruited athletes. From Model 2 to Model 3, the same phenomenon seen in Nuke midshipmen occurs. Initially, Model 2’s marginal effect for male blue-chips shows an 18% less probability ( $p < .01$ ) for these midshipmen to receive an ‘A’ grade. But, the addition of third party assessment data and personality types in Model 3 decreases this likelihood to about 14.7% ( $p < .01$ ). For women blue-chip athletic recruits, the only relationship is a relatively weak one ( $p < .10$ ) in Model 2 showing a positive relationship between female recruits and an ‘A’ in performance grades. Male recruits show a weak negative relationship ( $p < .10$ ) in Model 3 showing a 4% lower likelihood of receiving an ‘A’ grade.

### *c. Quantitative Cumulative Multiple Variables*

The results show that the components of the cumulative multiple do well in predicting military performance grades. Many of the variables in this section are significant and appear, at least collectively, to have a fair amount of impact in who receives and ‘A’ in performance. For those variables that are significant in both Models 2 and 3, the marginal effects are essentially unchanged; the addition of the variables used in the Model 3 do not appear to add explanatory power in predicting military performance grades. Of note, high school rank and the athletic ECA scores are the strongest positive predictors for receiving an ‘A’ in military performance. A 100 point increase in high school rank has a 6.9% positive change in one’s chances of receiving an ‘A’, and a 100 point increase in the athletic ECA score gives one a 3.5% increased

likelihood of attaining an 'A'. Both are significant in Models 2 and 3 at the 1% level. SAT scores, as well, have a positive impact, both that math and verbal portions positively influence's one's chance of receiving an 'A' by about 3%, with a significance at the 5% level.

The non-athletic ECA scores are also significant at the 5% level; but, their marginal coefficient is rather small (a 100 point positive change increases the probability of a midshipmen receiving an 'A' grade by about 1.5%). Taking into consideration CIS and TIS scores, something happens from Model 2 to 3 in that the significance goes from the 1% level for the CIS and 5% level for the TIS, becoming non significant in Model 3. This may mean that, all else being equal, the type of major likely to be chosen (TIS) and the level of commitment a midshipman had in the admissions process has little if any to do with their military performance grades. Another interesting observation to make about the TIS score is, that in Model 2, it is negatively associated with receiving an 'A' in military performance; so, those with better TIS scores are less likely to receive an 'A' grade. One explanation might be that midshipmen with higher TIS scores populate the technical (science and engineering) majors at a higher rate. These majors are often said to more demanding and require more effort or time on the part of a midshipman when compared to non-technical majors at the Naval Academy (although such a blanket statement is and should be open to vigorous debate). If, in fact one makes such an assumption, the additional resources needed by these majors may mean that midshipman devote less time to other parts of their Naval Academy life, and this manifests itself in lower military performance grades. However, it remains to be seen if in fact those midshipmen with higher TIS scores do enroll in technical majors at a higher rate. Future studies would do well to include the major group<sup>6</sup> midshipmen are in to shed more light on this subject.

#### *d. Qualitative Variables*

There are several observations to be made after reviewing what the qualitative variables have to offer in predicting an 'A' in military performance. First, the majority of the variables are significant at the 1% level. One can reasonably conclude

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<sup>6</sup> Group I majors are engineering majors. Group II majors are math and science majors. Groups III major are humanities and social science majors.

that qualitative variables have much to offer. Beginning with the teacher recommendations, a 100 point change is positively associated with an almost 5% more likely probability of receiving an 'A' in performance, and this finding is significant at the 1% level. Next, the RAB categories, as a group, seem to have more influence in the lower cumulative multiple ranges; ranging from a 1% to 1.5% positive influence. Also, half of the eight RAB category variables are significant at the 1% level. The other half have two variables significant at the 5% level and 1 variable significant the 10% level. By and large, RAB categories are worth including in statistical regressions attempting to predict which midshipmen receive an 'A' in military performance.

Lastly, personality points to a rather clear and potentially unsettling finding. According to the last model, at best, someone that is not of the Guardian personality is significantly ( $p < .01$ ) less likely to receive an 'A' grade. Midshipmen with a Rational personality are 5% less likely; while an Idealist is about 8% less likely to receive an 'A' grade. Artisans are over 14% less likely. Comparing the marginal effect for Artisans to the observed difference between Guardians and Artisans in Table 33 (17%), one sees that the model explains only 3% of the difference in receiving an 'A' grade. But, the third model does a much better job of explaining the observed differences between Guardians and the Idealists or Rationals; about half the observed difference for midshipmen with these two personality types is explained by the third model. To close, the qualitative variables provide for a more accurate way to predict one's military performance grade; an essentially subjective or qualitative measure of midshipmen success. This accuracy is also seen in the prediction tables.

*e. Model Goodness of Fit Analysis*

The prediction statistics follow a simple trend. With each subsequent model, the predictive accuracy of those that received an 'A' and those that did not increases; but, not at the expense of the each other. This shows that, for the most part, the variables work well together when combined in the logistic regressions. More specifically, from Model 1 to Model 3, the total cases correctly classified rose from 53%, and at the same time the Pseudo R Squared statistic rose from .020 to .158, a rather large and positive change. Having seen this synergy for the 'A' grades it will be interesting to

see if the same applies for the logistic models that attempt to predict which midshipmen are below average and receive a 'C' in performance.

## **2. A 'C' in Military Performance**

Table 41 below contains the marginal effects of the independent variables for the binary logistic models used to predict which midshipmen receive the overall grade of a 'C' in military performance (yes = 1; no =0). The discussion of the variables specified across three models will follow the same format as above. Before this analysis is given, it is helpful to note that positive marginal effects should not be interpreted as an advantage, since anything that increases the likelihood of earning a 'C' in military performance places one in the lowest grade category and is indicative of inferior military performance.

**Table 41. Marginal Effects of Independent Variables on C Military Performance Grades**

Variables	Marginal Coefficients		
	Model 1	Model 2	Model 3
African American	0.1471 ***	0.0949 ***	0.0833 ***
Hispanic	0.0583 ***	0.0400 **	0.0192
Asian American	0.0127	0.0273	0.0292
Other	0.1735 ***	0.1452 ***	0.1382 ***
Gender	-0.0284 *	0.0091	0.0125
2000	0.0294	0.0257	0.0351
2001	0.0355 *	0.0312	0.0430 **
2002	0.0611 ***	0.0534 ***	0.0516 **
2003	0.0880 ***	0.0681 ***	0.0723 ***
2004	0.0893 ***	0.0742 ***	0.0806 ***
Prior Enlisted		-0.0588 **	-0.0707 **
Legacy		0.0042	0.0054
NAPS		-0.0300	-0.0466 **
Foundation		-0.0366	-0.0484
Nuke		0.0125	-0.0195
BOOST		-0.0537	-0.0539
Male Athletic Recruit		0.0181	0.0264
Male Blue Chip Recruit		0.0714 ***	0.0587 ***
Female Athletic Recruit		0.0248	0.0427
Female Blue Chip Recruit		-0.0204	-0.0396
SAT Math / 100		-0.0065	-0.0225 **
SAT Verbal / 100		-0.0246 ***	-0.0348 ***
High School Rank / 100		-0.0468 ***	-0.0530 ***
Athletic ECA / 100		-0.0094 *	-0.0119 **
Non-Athletic ECA / 100		-0.0195 ***	-0.0205 ***
Career Interest Score / 100		-0.0076	-0.0033
Technical Interest Score / 100		0.0020	-0.0031
Teacher Recommendations / 100			-0.0265
RAB Category 1: CM <58k			-0.0052 **
RAB Category 2: CM 58 - 60			-0.0078 **
RAB Category 3: CM 60 - 62			-0.0128 ***
RAB Category 4: CM 62 - 64			-0.0136 ***
RAB Category 5: CM 64 - 65.5			-0.0107 **
RAB Category 6: CM 65.5 - 67			-0.0143 **
RAB Category 7: CM 67- 70			-0.0097 *
RAB Category 8: CM 70-79			-0.0011
Idealist			0.0549 ***
Rational			0.0725 ***
Artisan			0.0779 ***
Model Chi-Square	117.3693	351.5055	447.4203
-2 Log Likelihood	3930.7735	3696.6373	3600.7226
Pseudo R Squared	0.0424	0.1240	0.1563
Percent Correct No C Grade	61.4	68.1	68.3
Percent Correct C Grade	54.7	62.1	65.5
Overall Percent Correct	60.4	67.2	67.9

\*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$



**a. *Demographic Group, Gender, and Class Year***

Starting with demographic group results, Hispanics initially are (in Model 1) 5.8% more likely ( $p < .01$ ) to earn a 'C' military performance grade. But, by Model 3 (the most robust), the estimated marginal effect for Hispanics falls to 1.9% and is no longer significant. What this suggests is that Hispanics are likely to receive a 'C' in military performance due to lower SAT scores, high school rank (quantitative measures), or other lower qualitative measure; not because of unobservable factors related to being Hispanic (e.g., discrimination). For Asian Americans, the coefficients for all three models are also statistically insignificant. Conversely, African Americans, across all three models, are more likely to receive a 'C' in military performance; although each subsequent model has a lower marginal effect. However, Model 3 still shows African Americans being about 8% more likely to receive a 'C' in military performance after controlling for the numerous other independent variables. In addition, the marginal effects for African Americans are all significant at the 1% level. Midshipmen in the Other category follow the same trend as African Americans; but it is prudent to avoid making any observations for this group. There are less than 80 midshipmen in the data set belonging to the Other group. Low group populations have a tendency to make marginal coefficients inaccurate.

For women, there is good news in the sense that only Model 1 showed a relationship ( $p < .01$ ) benefiting women (keeping them out of the 'C' category at a lower rate than the reference group). Models 2 and 3 have marginal effects close to zero and neither are significant. Women appear to be neither adversely favored nor biased against in the distribution of 'C' grades as compared with the Brigade as a whole. As for class year, the trend follows the observed statistics presented in Chapter IV; year after year there are more 'C' grades and fewer 'A' grades given for military performance.

**b. *Accession Source, Athletic Recruit, Prior Enlisted, and Legacy***

For the most part, these variables do not have much impact on 'C' grades; but, there are some exceptions. Prior enlisted midshipmen appear to avoid the 'C' category of military performance grades. Model 2's marginal coefficient is just under 6% and Model 3's is 7% for prior enlisted midshipmen; both are negatively associated with

receiving a 'C' grade and significant at the 5% level. Next, the only variable with statistical significance at the 1% level is the male blue-chip recruit athlete. With the addition of the variables in Model 3, the marginal effect drops from a 7% increased likelihood of receiving a 'C' to just under 6%. Lastly, NAPSters, like prior enlisted midshipmen seem to enjoy a 4.5% less likelihood in receiving a 'C' in performance ( $p < .05$ ). All the other variables in this group are not significant. They appear not to have any meaningful impact or predictive power in determining 'C' grades.

*c. Quantitative Cumulative Multiple Variables*

The results of Table 44 suggest that the major components of the cumulative multiple reduce the likelihood of earning a 'C' in military performance. For the most part, better scores in the individual variables that make up the cumulative multiple equate to a lower probability of being awarded a 'C' in military performance, the lowest acceptable grade that does not initiate procedures determining one's fitness to continue attendance at the Naval Academy. The most predictive variable of this group is high school rank. It has the largest marginal effect in both Model 2 and 3; a 100 point change in high school rank reduces the chances of a 'C' military performance grade by 5.3 percentage points ( $p < .01$ ).

The marginal effect for a midshipman's SAT verbal score is raised by 1 percentage point (2.5% to 3.5%) from Model 2 to 3. This observation seems to suggest that the qualitative variables excluded in Model 2 raised the probability of earning a 'C'; but once the factors are explicitly accounted for in Model 3 we notice lower high school rank scores increase the chances of earning a 'C' by even a greater amount than in Model 2.

Interestingly, by Model 3, non-athletic ECA score's marginal coefficient (-2.1%) is almost the same as that of the SAT math score (-2.3%), and with a higher level of significance (1% versus 5%). Both these variables show a positive relationship in that a higher score reduces the likelihood that a midshipman will receive a 'C' grade. As for the athletic ECA score, the marginal effect increases from the second to the third model, but the positive impact this variable would have on avoiding a 'C' grade (-1.2%) is still

small compared to the other variables in this group. Lastly, CIS and TIS scores do not have any significant impact in one's probability of receiving a 'C' grade.

***d. Qualitative Variables***

The majority of the qualitative variables, similar to the findings for the 'A' military performance grades models, are statistically significant. The marginal effects for the teacher recommendation scores and RAB categories are all negative in sign; that is, the higher one's score in any particular variable, the less likely one is to receive a 'C' grade. The marginal effects are small, and only two are not significant; specifically, the teacher recommendations and the 8th RAB category are not. In contrast, the results of the teacher recommendation score from the 'A' military performance grade model showed a hundred point increase in the score improved a midshipman's probability of receiving an 'A' by 5 percentage points ( $p < .01$ ). This might suggest that the teacher recommendations score, as a variable, is defined by how well a particular midshipman did in high school, and this make it difficult to predict how poorly (a 'C' grade) one will do in military performance at the Naval Academy. As for the 8th RAB category, by the time someone is found to be this qualified, any additional qualitative information captured in the RAB scores is probably superfluous and therefore not significant. The other seven RAB categories generally follow the same trend established in the 'A' military performance model in that the middle RAB categories (categories three and four) have the larger estimated marginal effects and are statistically ( $p < .01$ ).

Finally, the marginal coefficients for personality types all show a positive relationship to receiving a 'C' grade ( $p < .01$ ). Generally, if a midshipman is not a member of the most populous personality group (e.g., Guardians), then he or she is 5% to 8% more likely to receive a 'C' in military performance. Overall, this model does a better job explaining the observed differences in 'C' grades between Guardians and the other three personality types than did the model for 'A' military performance grades.

***e. Model Goodness of Fit Analysis***

The model goodness of fit statistics are better in subsequent models with the addition of quantitative and then qualitative variables. The Pseudo R Squared statistic increases by a factor of four from Model 1 to Model 3 (4% to 16%), and the overall

percent correct classifications rose from 55% in Model 1 to 66% in Model 3 (just slightly higher than the 64% for final 'A' military performance grade model). Lastly, the prediction tables for all three models show that they did a better job in predicting who did not receive a 'C' in performance than those receiving the 'C'. This likely due the fact that only 15.5% of the data set received a 'C' grade. Anytime a sub population is less than 20% of the general population, it is difficult for a binary logistic regression to properly predict outcomes (W. Bowman (of USNA Economics Department), personal communication, February, 2005).

### **3. Trends Between the 'A' and 'C' Models**

The primary observation to make between both models is, that by the third and most robust model, Hispanics are neither more or less likely than the reference group (Caucasians) to receive 'A' or 'C' military performance grades; but Africans Americans appear to be. They are disproportionately found more often in the 'C' versus the 'A' grade group. Although much of the gap in military performance grades for African Americans is explained by quantitative and qualitative variables captured by Naval Academy Admissions and Institutional Research, there is still a 'residual' performance gap that may be due to unobserved characteristics. Females appear to be at a disadvantage in receiving 'A' grades; but avoid any undue overrepresentation in the 'C' grades for military performance. The marginal effects for class year variables simply reflect the trend that with each successive year, fewer 'A' grades are given to the midshipmen, while at the same time more 'C' grades are granted.

Prior enlisted midshipmen appear to have some innate quality that make them predisposed to higher military performance grades. Legacy midshipmen do not appear to have any advantage or disadvantage; this may be due how this variable is measured more than anything else. The definition for legacy midshipmen may simply be too broad and not specific enough in identifying those midshipmen that had some influence from a father or mother who were career service members. Taking into consideration recruit athletes, the only consistent finding is that male blue-chip recruited midshipmen, like African Americans, at a disadvantage in receiving 'A' grades, and conversely, more likely to receive a 'C' grade. For the most part, the components of the cumulative multiple do well in predicting military performance. Lastly, despite the fact that

personality is used in a manner not intended by Myers Briggs Foundation, it does show a rather interesting trend. If a midshipman is not of the Guardian personality, they, like African Americans and male blue-chip recruit athletes, have an increased likelihood of earning a 'C' and a decreased likelihood of earning an 'A' military performance grade.

#### **E. CUMULATIVE ACADEMIC QUALITY POINT RATING**

The following table shows the un-standardized coefficients attributed to the independent variables for three ordinary least squares regression models with cumulative academic QPR as the dependent variable. The coefficients are analyzed in the same manner used in studying the marginal effects of the logistic models; but, some clarification will be necessary. A coefficient signifies either an increase or decrease in a particular midshipman's cumulative academic QPR (scale from 0.0 to 4.0) in comparison with the reference group for the regressions. This reference group is comprised of midshipmen who meet the following criteria:

- Male
- Caucasian
- Matriculated directly from high school
- Not recruited for a varsity sport
- Non prior enlisted
- Has no legacy status
- Has a Guardian personality

**Table 42. Unstandardized Coefficients of Independent Variables on Cumulative Academic QPR**

Variables	Coefficients		
	Model 1	Model 2	Model 3
African American	-0.5031 ***	-0.1854 ***	-0.1586 ***
Hispanic	-0.2638 ***	-0.1232 ***	-0.0814 ***
Asian American	-0.0477	-0.1122 ***	-0.1123 ***
Other	-0.2164 ***	-0.0570	-0.0183
Gender	-0.0062	-0.0905 ***	-0.0974 ***
2000	-0.0079	-0.0149 *	-0.0245
2001	0.0480 *	0.0452	0.0310
2002	0.0242	0.0190	0.0162
2003	-0.0083	0.0480 **	0.0365
2004	0.0254	0.0673 **	0.0555 **
Prior Enlisted		0.1061 ***	0.1375 ***
Legacy		-0.0144	-0.0170
NAPS		0.0852 ***	0.0902 ***
Foundation		-0.0378	-0.0164
Nuke		0.1216 **	0.1627 ***
BOOST		0.01782	0.1558
Male Athletic Recruit		0.0462	0.0359
Male Blue Chip Recruit		-0.0928 ***	-0.0564 **
Female Athletic Recruit		0.0953 **	0.0791 **
Female Blue Chip Recruit		0.0412	0.0748 *
SAT Math \ 100		0.2101 ***	.2292 ***
SAT Verbal \ 100		0.1008 ***	.1090 ***
High School Rank \ 100		0.1916 ***	.2011 ***
Athletic ECA \ 100		0.0087	0.0117
Non-Athletic ECA \ 100		-.0180 ***	-.0148 **
Career Interest Score \ 100		.0332 ***	.0284 ***
Technical Interest Score \ 100		-.0318 ***	-0.0191 **
Teacher Recommendations \ 100			0.0363 ***
RAB Category 1: CM <58k			0.0139 ***
RAB Category 2: CM 58 - 60			0.0207 ***
RAB Category 3: CM 60 - 62			0.0219 ***
RAB Category 4: CM 62 - 64			0.0266 ***
RAB Category 5: CM 64 - 65.5			0.0226 ***
RAB Category 6: CM 65.5 - 67			0.0217 ***
RAB Category 7: CM 67- 70			0.0258 ***
RAB Category 8: CM 70-79			0.0197 ***
Idealist			-0.0393 **
Rational			-0.0649 ***
Artisan			-0.0710 ***
R <sup>2</sup>	0.053	.226	.335
F	30.61	54.76	70.4
Sig	0.000	0.000	0.000

\*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

## **1. Demographic Group, Gender, and Class Year**

The first observation to make is, that in Model 3, all midshipmen (except for Caucasian/reference and 'Other' midshipmen) are predicted to have a lower cumulative academic QPR (cumaqpr), and this is significant ( $p < .01$ ). Hispanics have the smallest decrease at -.08 points. Asian Americans have the next smallest decrease at -.11. African Americans have the largest decrease to one's cumulative academic QPR at -.15 points. So, after controlling for the numerous pre-entry variables, it would appear that the vast majority of minority demographic groups remain at a disadvantage in comparison with the reference group in terms of cumulative academic QPR. Why? It could be that a more robust model, one that incorporates post-entry variables may minimize the influence the mere status of being a minority would have on cumaqpr. Another explanation is that there is some quality (as yet unidentified) these three demographic groups have in common (to varying degrees) that somehow makes them prone to have more academic difficulty. Only midshipmen in the 'Other' demographic group appear to be immune from any positive or negative effects on their cumaqpr attributed to their demographic group status.

Females, according to Models 2 and 3 follow the same trend established by the demographic group variables; they are likely to have a cumaqpr about .09 points lower than the average ( $p < .01$ ). Lastly, no appreciable trend is evident in the class year variables; although, those in the class of 2004 benefit positively by being .055 to .067 points above the average cumaqpr ( $p < .05$ ).

## **2. Accession Source, Athletic Recruit, Prior Enlisted, and Legacy**

This group of variables continues to follow some trends found in the binary logistic models. First, in Models 2 and 3 prior enlisted midshipmen can expect a slightly better cumaqpr by about 0.10 to 0.14 points once other pre-entry variables are controlled for ( $p < .01$ ). NAPSters, as well, share a .09 point advantage in cumaqpr ( $p < .01$ ). Another accession source, midshipmen from the Nuke pipeline, have the largest boost in their cumaqpr of all the accession sources in the models. These midshipmen, by the third and most robust model are predicted to have their cumaqpr about .16 points higher than the reference ( $p < .01$ ). Concerning athletic recruits, male blue-chip athletic recruits

continue to be at a disadvantage. These midshipmen show a .06 point reduction in their mean *cumaqpr* versus the reference group ( $p < .05$ ) in Model 3. Fortunately, this disadvantage is smaller compared to the -.09 coefficient for this group in Model 2 ( $p < .01$ ). Perhaps, with additional post-entry variables, this difference may be reduced even further. Or it may be, like the demographic group variables, that there is something distinctive about these male midshipmen not yet made known. Lastly, female recruited athletes (of both types) appear to have a weak, but positive relationship with *cumaqpr*. It is possible that women involved in sports have an added support network that women who aren't recruited for sports would otherwise not have. This support may help women cope in the predominately male dominated institution of the Naval Academy; which, to a certain extent may be seen in their academic grades.

### **3. Quantitative Cumulative Multiple Variables**

Unlike previous models, no definitive trend appears when focusing on the quantitative cumulative multiple variables. SAT math and verbal scores and high school rank all positively contribute to a higher mean *cumaqpr* ( $p < .01$ ), reflecting what was hypothesized in Table 23. Athletic ECA scores are not significant in Model 2; but they are in others. This should not come as a surprise since one's Athletic ECA score reflects how well-rounded one is; but not necessarily how well prepared a midshipman is for the academic rigors of the Naval Academy. As for the non-athletic ECA score and TIS score, the better or higher score one has in the application process, the lower their mean *cumaqpr* will tend to be. It might be that those with particularly high non-athletic ECA scores are willing to sacrifice some of their academic performance in order to be involved in the many ECA activities offered at the Naval Academy. As for the TIS score, midshipmen with higher scores may be populating technical majors at a higher rate; majors that may be more difficult to maintain a *cumaqpr* that is in par with the *cumaqpr* of midshipmen in non-technical majors. Lastly, one's CIS score appears to have a positive effect on the *cumaqpr* ( $p < .01$ ). This may be because those midshipmen with higher CIS scores may have certain qualities (a greater propensity to persist through four years at the Naval Academy, more dedication and motivation) that carry over to better academic performance as well.



#### **4. Qualitative Variables**

The trend seen in RAB impact, teach recommendations, and personality is rather straightforward and, with the exception of the personality types, the rest of the variables all positively impact the mean cumulative academic QPR of a particular midshipman. For example, regardless of what RAB Category a particular midshipman is in, each 500 point increment in one's Recommendation of the Admissions Board (RAB) score raise one's cumulative academic QPR roughly .014 to .036 points ( $p < .01$ ). Furthermore, compared to Guardians, all three personality types are expected to have from .04 to .07 lower average academic grades ( $p < .01$  for Rationals and Artisans,  $p < .05$  for Idealists).

The importance of these added variables is also shown in the R squared statistic change from Model 2 to Model 3, with an increase of almost 11 percentage points. The largest impact belongs to the teacher recommendation scores, they encapsulate unbiased assessments from the high school english and math teachers of most midshipmen. The next salient finding from Model 3 is that all the RAB category variables provide some effect on cumulative academic QPR. In the earlier models run for the other dependent variables we found that some of the RAB category variables are statistically significant, but not all the RAB categories. It would appear that the qualitative information capture by the RAB scores has more impact in predicting cumulative academic QPR than other measures of success in this study. Lastly, as discussed above all the coefficients for the personality type variables are negative. This trend mirrors that for the binary logistic model attempting to predict 'C' military performance grades; but finding a reasonable explanation for this outcome may prove difficult at best. How does one link a personality type to lower academic performance? Before delving into this question, doing more research in how to properly incorporate personality measures into performance models should be completed.

#### **F. CHAPTER SUMMARY**

This chapter analyzed a total of fifteen statistical regression models. The following summary coalesces the most salient trends made known from the regression models with the most independent variables (Model 3). Of the three models run for each

dependent variable representing a measure of midshipmen success, Model 3 is assumed to be the most robust. The following points are organized by the variable grouping used throughout the chapter.

### **1. Demographic Group, Gender, and Class Year**

Of the four dependent variables, only the dependent variable of cumulative academic QPR model had a negative and statistically significant marginal effect for Hispanics. For the other measures of success, Hispanics are neither favored nor adversely affected by their status. So, for the most part, Hispanics appear, at least by the findings of these models, to be doing well at the Naval Academy regardless of the observed differences reported in Chapter IV. Comparing these findings with the hypothesized effects in Table 23 shows that only the predicted (unknown) effect of being a Hispanic Midshipman on cumulative academic QPR and Brigade leadership (positive) was incorrect; the predictions for graduation (unknown) and military performance grades (unknown) can be supported by the regression results. To close, if one compares the observed differences Hispanics have in their graduation rates, leadership positions, or military performance to Caucasians, these differences are likely to be attributed to the other control variables used in the model, or potential variables that were excluded from the model, and not something specific to Hispanics.

For African American midshipmen, the results show that they attrite at a higher rate (by 4.4% with  $p < .10$ ) and perform below that of the majority in academics and military matters. They are 8.3 % less likely to receive an 'A' in military performance ( $p < .05$ ) and 8.3% more likely to receive a 'C' in military performance ( $p < .01$ ). But, African Americans are favored (by 3%) for senior leadership positions their last year ( $p < .01$ ). Lastly, African Americans were the only demographic group that had statistically significant findings for all measures of midshipmen success and whose predicted outcomes for all four measures of success in Table 23 were correct (positive relationship for Brigade leadership and negative for the other three measures of success).

For Asian Americans, there were only two statistically significant findings. As hypothesized in Table 23, Asian Americans were 5.6% less likely to receive an 'A' in military performance ( $p < .10$ ). Contrary to the prediction in Table 23, these midshipmen

were also likely to have a cumulative academic QPR 0.11 points lower ( $p < .01$ ) than the reference group (Caucasians). Lastly, midshipmen with the “Other” affiliation for demographic group are not as likely to graduate and more likely to have lower military performance scores; but, these findings should be tempered with the fact that there are very few (78) midshipmen in this group, making it difficult produce credible findings from regression analysis.

As for women, they attrite at a higher rate (by 13.3%), have lower academic performance (by 0.1 points), and are 8.3% less likely to receive ‘A’ military performance grades (all with a  $p < .01$ ). But, like African Americans, women are favored for senior leadership positions by 1.1% ( $p < .10$ ); and like African Americans, the hypothesized outcomes made in Table 24 support the relationships made known from the findings for all four measures of success.

## **2. Accession Source, Athletic Recruit, Prior Enlisted, and Legacy**

Certain points are worth highlighting in this section. First, prior enlisted midshipmen are more likely to achieve the highest military performance grade; and less likely to receive a ‘C’ in military performance. Legacy midshipmen are not found to be statistically significant in any model, and this may very well be because of the way the variable was measured. NAPSters are more likely to graduate and they are more likely to have a higher cumulative academic QPR once other factors are controlled for in the regression models. Thus, it would seem that NAPS is fulfilling its obligation set forth in its mission statement which is, “...to prepare selected candidates morally, mentally, and physically, with emphasis on strength[en]ing the academic foundation of individual candidates for officer accession through the U.S. Naval and Coast Guard Academies...” (Naval Academy Preparatory School, 2005). Finally, male blue-chip recruit athletes, like African American midshipmen are less likely to receive an ‘A’ in military performance, and more likely to receive a ‘C’ in military performance. This is gender specific because the same does not apply for female blue-chip recruit athletes.

## **3. Quantitative Cumulative Multiple Variables**

The quantitative cumulative multiple variables, for the most part, show that higher scores are associated with a higher probability of success, with one exception.

Midshipmen with higher non-athletic ECA scores and TIS scores are more likely to have a lower cumulative academic QPR. Overall, the cumulative multiple continues to be a useful tool in predicting midshipmen success.

#### **4. Qualitative Variables**

Generally, the qualitative added to create the third and final model were found to have predictive value. Guardians are favored for higher military performance scores and better academic scores. For midshipmen in the lowest range of the cumulative multiple scores, qualitative information captured by the RAB category variable help them matriculate into the Naval Academy; but, these qualitative assessments don't positively increase the likelihood of graduation. However, RAB scores awarded throughout the cumulative multiple range are positively related to a midshipman's cumulative academic QPR.

#### **5. Closing Comments**

While the focus of this study centered on Hispanic midshipmen, there is much information about many other different groups of midshipmen. The findings only begin to make known certain new relationships about midshipmen and their environment at the Naval Academy. Future studies can and should capitalize on this new information.

## **VI. CONCLUSIONS AND RECOMMENDATIONS**

This study began with the history and participation of Hispanics in our nation's defense as far back as the Revolutionary War, and ended with how Hispanic midshipmen fare at the Naval Academy. In between, their involvement in the War of 1812, the Civil War, the Spanish American War, WWI, and WWII, their improving progress and increased enrollment in higher education, and the findings of previous studies on midshipmen at the Naval Academy were also covered. Next, the methodology for studying Hispanics at the Naval Academy was detailed, describing the four measures of success (graduation, Brigade leadership, military performance grades, and cumulative academic QPR). Independent variables used for regression analysis were defined and operationalized. Chapter IV presented preliminary descriptive findings for the independent and dependent variables. These findings were followed by an analysis of predictive factors for the four measures of success at the Naval Academy in a sequence of increasingly complex regression models. This final chapter reviews and answers the questions posed in Chapter I and makes recommendations for future research.

### **A. RESEARCH QUESTIONS**

The first research question of this study was, "Are there appreciable differences in Hispanic midshipmen success (graduation, leadership, military performance, and academic performance) relative to other ethnic, racial, or gender groups at the Naval Academy?" The answer is yes; which leads to the next question. It is, "...where do these differences manifest themselves?" Of the five regression models run, it would appear that Hispanics are at a disadvantage in cumulative academic QPR. But, why is this so? SAT scores, and high school rank, the two most influential factors in academic performance, and a host of other variables used to control for any potential differences in midshipmen success, are not able to explain all the observed differences Hispanics have in academic grades. Interestingly, this applies for all the other minority groups as well (to include women).

It could be that there might be some type performance gap for these midshipmen that exist prior to matriculation. The gap may exist as a result of the quality of their high

school (and earlier) education, or may be found in other 'out of school' areas. Because the Naval Academy strives to look at the whole person (quantified in the Whole Person Multiple) during the application process, these gaps, if they exist, would be important but may be difficult to measure under the current application process. This gap may persist in midshipmen even after Induction Day and ultimately manifest itself, to varying degrees, in the measures of success used in this study.

The next question posed in Chapter I asked if there were other appreciable differences (not directly related to Hispanics) revealed in this study. When one considers African Americans and females, the answer is yes; especially in determining who will become the four strippers or above in the Brigade. African Americans are the only demographic group to be overrepresented (by 3%) in being the senior leaders of the Brigade (significant at the 1% level). Women are also overrepresented, though to a lesser extent (by 1% and significant at the 10% level), in the senior first class leadership positions. So, given that African Americans are not the largest minority group at the Naval Academy (and haven't been since 2000), one can't help but wonder why this disproportionate representation exists. It may be that African Americans and women are the most visible minorities; while Hispanics, because they can encompass so many diverse groups of people are not seen in the same light.

This finding might also be affected by the selection process of the four strippers and above which is voluntary on the part of the midshipmen (i.e., they must submit their name for consideration). The demographics of the volunteer pool is unknown; but this may impact who eventually is appointed to a four stripper or above position. Ultimately, the decision is made by the Commandant of Midshipmen. Although only three strippers, the most recent list of thirty company commanders (midshipmen having the rank of Midshipman Lieutenant) submitted for the fall 2005 semester has been sent back to Battalion and Company Officers before final approval because it was not considered diverse enough (Leidig 2005). It will be telling to see if the pattern of results found by this study continues.

Women and African Americans (both male and female) are disadvantaged in receiving an 'A' military performance grade (i.e. underrepresented relative to their

overall proportion in the dataset). However, models analyzed for this study do not include post-entry interactions (involvement or participation in company activities, extra-curricular activities (ECAs), and varsity or club athletics) of midshipmen. If, in fact, even more robust regression models that incorporate post-entry interactions continue to show that women and African Americans are at a disadvantage in receiving an 'A' in military performance, the implications may extend beyond the walls of the Naval Academy. Roger's 2003 study into military performance scores found that higher scores had a positive and significant impact on officer fitness reports, promotion, and retention. What this may mean is that women and African Americans (and other groups with a lower likelihood of attaining higher military performance grades) may be at a disadvantage in attaining success in the fleet.

Another finding unrelated to Hispanics was the impact of personality types in predicting military performance grades. Of all the findings in this study, this one is the most striking and unexpected because of the strength of the relationship between the Rational, Idealist, and Artisan personalities and lower military performance (all with  $p < .01$ ). All three personality groups are less likely to receive the highest grade (an 'A' in military performance), more likely to receive the lowest grade (a 'C' in military performance). Additionally, these midshipmen (which constitute 58% of the data set) are likely to have a lower cumulative academic QPR compared to Guardians (all with  $p < .01$ ). Moreover, Artisans are also 1.6% less likely to be a four striper or above ( $p < .05$ ). Lastly, all else being equal, Idealists are 11.1% less likely ( $p < .01$ ) and Artisans are 4.1% less likely ( $p < .05$ ) to graduate. One possible explanation is that those midshipmen with a Guardian personality type (duty bound, prefers tradition, ceremony, and service to others) may have the best fit into military culture. Another is that the Naval Academy is somehow structured such that Guardians are favored in terms of the criteria used to measure success. To close, the findings on personalities have strong relationships and are seen, to varying degrees, in all the measures of success; but, the most concrete findings are those in the military performance regression models.

## **B. RECOMMENDATIONS FOR FUTURE RESEARCH**

Many studies of midshipmen have been done in years past focusing on their performance. To date, however, those studies have not focused specifically on Hispanics

at the Naval Academy. This study addressed that issue focusing on pre-entry variables, all used by the Admissions Board (with the exception of personality type). It was found that all the independent variables (with the exception legacy) have, to varying degrees, predictive worth in determining who succeeds at the Naval Academy. In the process of conducting this study, suggestions for further research emerged. How would one assemble another study that complements this one? The recommendations below, if taken one by other researchers, can continue the progress made thus far.

### **1. Create Models of Midshipmen Success that Incorporate Pre and Post-Entry Variables**

A future study may want to incorporate pre and post-entry variables to predict graduation, striper, military performance grades, and cumulative academic QPR. This suggestion was alluded to several times throughout this study. To start, one might include the type of major chosen and conduct grades (a measure of how well a midshipman adheres to rule and regulations); both variables easily accessible to future researchers. In addition to these variables, measures of company, ECA, and sports participation could also be analyzed to determine their impact on the success of midshipmen at the Naval Academy.

### **2. Change Operational Definitions**

Future revised models could modify the operationalization of some of the variables used in this study to potentially yield more meaningful results. As an example, future research could broaden the definition of leadership to include three stripers or above instead of four stripers or above as a measure of success at USNA. Midshipmen Lieutenants are, like those with higher rank, in very visible leadership positions, and like four stripers and above, they must volunteer for their leadership positions. Additionally, models attempting to predict three stripers or above will have a larger  $n$ ; likely resulting a better model results (e.g. percent correct).

The legacy variable may also benefit from a modified operationalization since it did not add much to the study when previous research suggests it should have. Midshipmen with a parent that is a career military service member (twenty or more years of service), or that is currently serving in the military at the time of matriculation to the Naval Academy may yield better results for the legacy variable.



### **3. Use Some Dependent Variables as Independent Variables**

Another technique that could be employed in future research would be to use some of the measures of midshipmen success as independent variables for models attempting to predict other measures of success. For example, one could run similar logistic regression models for strippers and military performance as dependent variables using cumulative academic QPR as an independent variable. The model results could be compared with those of this study to determine if females and African Americans continue to be negatively related to these measures of success, or if academic performance is found to explain findings made in this study.

### **4. Attempt a Qualitative Approach to This Research Topic**

A future researcher could administer surveys, hold focus groups, or conduct individual interviews with midshipmen, officers, or civilian faculty alike to ascertain the validity of the findings in this study. This approach may yield information that cannot be derived from the type of quantitative analyses used in this study. A qualitative study might be particularly appropriate to further examine the relationship between personality types and midshipmen military performance. Qualitative data could also be used to explain the disparity a particular demographic group, gender, or athletic recruit group has in one of the measures of success in this study. Lastly, a qualitative approach to research can begin to tackle questions that a strictly quantitative approach to research may be unable to do.

### **5. Further Research into Personality and Success at the Naval Academy**

Although not the focus of this study, personality was used as a way to control for any differences in midshipmen success (as were all the other independent variables). It was found that midshipmen with the Guardian personality (duty bound, prefers tradition, ceremony, and service to others) demonstrate higher military performance grades and academic QPR; but, we don't know why. If, in fact these midshipmen are "outperforming" other personality types, is it because the Naval Academy's metrics in measuring success favor Guardians? Are the Naval Academy staff (company officers, civilian and military faculty, and other staff) mostly Guardians, and if so, does this contribute to the differences? Are there mechanisms that can be used to increase the

success rate of non-Guardian personality types? Does personality type predict success beyond the Naval Academy? Further research in this area can answer these questions; but must begin with a thorough review of personality and its impact on performance in work environments.

### **C. CLOSING REMARKS**

Regardless if future findings agree with or contradict those made in this study, the result is the same -- a better picture of the collective landscape of Naval Academy life. This body of knowledge will give Naval Academy officials the confidence in knowing they are making better informed decisions upon which sound policy originates. As a result, the Naval Academy may continue to live up to its mission of "... provide[ing] graduates who are dedicated to a career of naval service..."

## **APPENDIX:        COMPONENTS OF THE CANDIDATE MULTIPLE**

<b>Predictor Variable</b>	<b>Definition</b>	<b>Predictive Value</b>
SAT Math	Measure of mathematical reasoning ability	Academic Performance
SAT Verbal	Measure of verbal reasoning ability	Academic Performance
High School Rank	A standardized score ( $x=500$ , $S.D =100$ ) based on an individual's high school rank ranging from 200 to 800	Academic Performance
Teacher Recommendations	This is a score based on high school officials' estimates of the individual's potential for success as a naval officer. These officials (normally English or Mathematics teachers) are asked to evaluate the candidate on effective communication skills, interpersonal relations, personal conduct, and leadership potential. A score derived by summing these evaluations may range from 0 to 1,000, with no minimum qualifying score required.	Military Performance
Athletic ECA Score Non-Athletic ECA score	Each applicant is asked to complete a rather extensive form that covers participation in both athletic and non-athletic activities during high school. An objective scoring system (not empirically derived) is used to compute an 2 scores that ranges from 300 to 800. No minimum qualifying score is required.	Non-Academic & Military Performance
Career Interest Score	A standardized score ( $x=500$ , $S.D =100$ ) based in the Strong Interest Inventory questionnaire ranging from 1 to 1000	Predict Voluntary Resignation & 4 Year (overall ) Attrition Likelihood of Retention (20 Year Career)
Technical Interest Score	A standardized score ( $x=500$ , $S.D =100$ ) based in the Strong Interest Inventory questionnaire ranging from 1 to 1000	Predict Technical Major

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